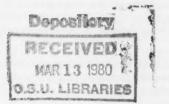
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SELECTED

# **SESOURCES**RESOURCES ABSTRACTS



VOLUME 13, NUMBER 3 FEBRUARY 1, 1980

W80-00801--W80-01200 CODEN: SWRABW

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## SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the Office of Water Research and Technology U.S. Department of the Interior



VOLUME 13, NUMBER 3 FEBRUARY 1, 1980

W80-00801--W80-01200

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most our our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

### **FOREWORD**

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographic citation and a set of identifiers or descriptors which are listed in the Water Resources Thesaurus. Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Office of Water Research and Technology.

To provide SWRA with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

The input from these Centers, and from the 54 Water Resources Research Institutes administered under the Water Research and Development Act of 1978, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies becomes the information base from which this journal is derived.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology U.S. Department of the Interior Washington, D.C. 20240

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### SELECTED WATER RESOURCES ABSTRACTS

### 1. NATURE OF WATER

### 1A. Properties

STATISTICAL SUMMARIES OF SURFACE-WATER-QUALITY DATA FOR SELECTED SITES IN OKLAHOMA, THROUGH THE 1975 WATER YEAR,

Geological Survey, Oklahoma City, OK. Water Resources Div.

Nesources Div.

J. K. Kurklin.

Geological Survey open-file report 79-219, May 1979, 171 p, 1 Fig, 5 Tab, 4 Ref.

Descriptors: \*Water quality, \*Streams, \*Oklahoma, \*Water analysis, \*Chemical analysis, Data collections, Sampling, Sites, Regression analysis, Reviews, Statistical methods, \*Value extremes.

Statistical summaries of surface-water-quality data for 47 streams in Oklahoma have been compiled. Data for the period of record through the 1975 water year at each site were used to develop regression equations for specific conductance-constituent relationships for calcium, magnesium, sodium, sodium plus potassium, bicarbonate, sulfate, chloride, silica, and dissolved solids. Tables iate, chloride, sinica, and dissolved solinos. Tables include minimum, mean, and maximum values for selected constituents for the period of record through the 1975 water and for individual water years. (Woodard-USGS) W80-00937

PUBLIC GROUNDWATER SUPPLIES IN CAR-

ROLL COUNTY, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 7C. W80-00946

### 1B. Aqueous Solutions and Suspensions

PROFILING WATER QUALITY SENSING General Dynamics, San Diego, CA. Electronics

For primary bibliographic entry see Field 5G. W80-01179

### 2. WATER CYCLE

### 2A. General

ESTIMATION OF DRAINAGE DENSITY FROM TOPOLOGICAL VARIABLES, Leicester Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 2E. W80-00953

COMPUTER APPLICATION TO DOUBLE-

COMPUTER APPLICATION TO DOUBLE-MASS ANALYSIS,
Asian Inst. of Tech., Bangkok (Thailand). Div. of Water Resources Engineering.
For primary bibliographic entry see Field 7C. W80-00970

THE ANNUAL WATER BALANCE. Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.

Civil Engineering. P. S. Eagleson. Journal of the Hydraulics Division, American So-ciety of Civil Engineers, Vol 105, No HY8, Pro-ceedings Paper 14781, p 923-941, August 1979. 9 Fig. 1 Tab, 19 Ref, 2 Append.

Descriptors: \*Water balance, \*Statistical analysis, \*Hydrologic cycle, Rainfall, Runoff, Evaporation, Groundwater, Climatology, Vegetation, Evaportanspiration, Atmosphere, Soils, Infiltration, Equations, Analytical techniques, Hydrology, Water resources.

The average annual one-dimensional water balance was expressed for natural surfaces in terms of

physically-significant dimensionless parameters. This provided the basis for dynamic similarity of the water balance and for an improved understanding of climate-soil-vegetation coupling. A sensitive analysis pointed out the critical importance of the potential rate of evapotranspiration in defining the potential rate of evapotranspiration in defining water balance variations due to changes in other climate and soil parameters. A first-order analysis of the average annual water balance gave an equation for the annual water balance that can be used to estimate the cumulative distribution functions (cdf) of the components of the annual water balance in terms of the cdf of the annual water balance in terms of the cdf of the annual precipitation and of observable parameters of the physical system. This provided a rational basis for assessing the risk due to physical changes in the land surface and for estimating the recurrence interval of such and for estimating the recurrence interval of such water balance components as basin yield. (Sims-ISWS) W80-01018

FROST GAUGES AND FREEZING GAUGES, Department of the Environment, Ottawa (Ontar-

io). Water Quality Branch.
J. A. Banner, and R. O. van Everdingen.
NHRI Paper No 3, IWD Technical Bulletin No
110, 1979. 18 p, 20 Fig. 1 Tab, 9 Ref.

Descriptors: \*Frost, \*Freezing, \*Gages, \*Depth, Resistance, Leakage, Damages, Soils, Soil water, Temperature, Mathematical studies.

Several types of frost gauges to detect frost (temperatures at or below 0 C) and several types of freezing gauges to determine the occurrence and extent of soil freezing (conversion of soil moisture from liquid to solid) were designed and constructed. The multisensor electrical-resistance freezing gauges enable determination of the progress, with time, of freezing and thawing in both saturated and unsaturated soils. In the case of unsaturated materiunsaturated soils. In the case of unsaturated materials, the use of temperature sensors or electrical-resistance or visual frost gauges makes it possible to distinguish between the resistance effects of freezing and those of drying of the soil. Computergenerated plots of resistance vs. depth and time are used in the interpretation of the data. Best results are obtained when freezing gauges with small electrode spacings, installed directly in the soil, are measured daily. (WATDOC) W80-01170

### 2B. Precipitation

APPARATUS AND METHOD FOR MEASURING LIQUID WATER CONTENT OF A CLOUD OR FOG.

Office of the Secretary of the Army, Washington, DC

DC. H. R. Carlon. U.S. Patent No 4,154,089, 6 p, 2 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 982, No 3, p 832, May 15, 1979.

Descriptors: \*Patents, \*Clouds, \*Fog, \*Moisture content, Meteoric water, Precipitable water, Instrumentation, Measurement, Equipment.

An apparatus and method for measuring the liquid water content of a cloud or fog utilizes an environ-mentally controlled test chamber having a plurality of oppositely disposed windows selected to be optically transparent at a chosen wavelength of radiation. The windows of the chamber are posiradiation. The windows of the chamber are posi-tioned intermediate an infrared source and a wave-length scanning radiometer. An optical band pass filter is selected to pass radiation of a specific wavelength making the instrumentation substan-tially independent of cloud droplet size distribution enabling the measurement of only liquid water rather than water vapor. (Sinha-OEIS) W80-00891

ATMOSPHERIC CONTRIBUTIONS TO STREAM WATER CHEMISTRY IN THE NORTH CASCADE RANGE, WASHINGTON, Washington Univ., Seattle. Dept. of Geological

For primary bibliographic entry see Field 2K.

WR0-00948

A NOTE ON THE DUAL-GAGE AND WYO-MING SHIELD PRECIPITATION MEASURE-MENT SYSTEMS, Science and Education Administration, Boise, ID.

Science and Education Administration, Boile, 1D. Northwest Watershed Research Center. C. L. Hanson, R. P. Morris, and D. L. Coon. Water Resources Research, Vol 15, No 4, p 956-960, August 1979. 5 Fig. 2 Tab, 11 Ref.

Descriptors: \*Idaho, \*Precipitation gages, \*Snowfall, \*Precipitation(Atmospheric), Rainfall, Gages, Winds, Gaging, Regression analysis, Measurement, \*Precipitation measurement systems, \*Wyoming shield, \*Reynolds Creek Experimental Watershed(ID), Alter shield, Dual-gage, Windy conditions, Annual precipitation, Windswept areas.

Analysis of 52 events, which included both snow-fall and rainfall, showed that the dual-gage and the Wyoming shield precipitation measuring systems measured nearly the same amounts at an unprotected site on the Reynolds Creek Experimental Watershed in southwest Idaho. These systems were developed to measure precipitation, more specifically snowfall, under windy conditions. The more legible record traces obtained from the Wyoming shield gage were a good reason for using this shield when installing precipitation gages at windy locations. (Roberts-ISWS)
W80-00957

RELATIONSHIP BETWEEN PRECIPITATION AND TORNADO ACTIVITY, National Severe Storms Forecast Center, Kansas

City, MO. J. G. Galway.

Water Resources Research, Vol 15, No 4, p 961-964, August 1979. 7 Fig, 4 Tab, 12 Ref.

Descriptors: \*Precipitation(Atmospheric), \*Torna-does, \*Correlation analysis, Rainfall, Droughts, Time series analysis, Data processing, Weather, Meteorology, Climatology, Statistics.

Precipitation and tornado statistics for three different geographic areas were compared. Weak correlations exist between yearly and seasonal precipitation totals and tornadic activity. Also, a slight trend for wet years to have more tornadoes than dry ones is present. However, tornadic activity does not appear to be related to the existence of drought. (Sims-ISWS) W80-00958

ECONOMICS OF WEATHER MODIFICATION:

A REVIEW, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 6B. W80-01008

HYDROMETEOROLOGICAL CHARACTERIS-TICS OF SEVERE RAINSTORMS IN ILLI-

Illinois State Water Survey, Urbana.

Available from the National Technical Information Service, Springfield, VA 22161 as PB80-110406. Report of Investigation 90, 1979. 6 Fig. 15 Tab, 13 Ref.

Descriptors: "Climatology, "Meteorology, "Illinois, "Storms, "Data collections, Rainfall intensity, Areal, Rainfall disposition, Movement, Shape, Analysis, Distribution, Probable maximum precipitation, Frequency, Temporal distribution, Deptharea-duration analysis, Seasonal, Probability, Time, Rainfall frequency, Severe rainstorms.

This report provided a summary of available information on heavy rainstorms in Illinois obtained from analyses of data from various sources. These data included climatological records of the National Weather Service, field surveys of severe rainstorms by the State Water Survey, and data collected from operation of several dense raingage networks in the state beginning in 1948. The major objective was to provide information useful in

### Field 2—WATER CYCLE

### Group 2B-Precipitation

hydrologic design projects. Primary emphasis was placed on the frequency distribution of areal mean rainfall in severe rainstorms having durations of 6 to 48 hours and producing excessive amounts over areas of 25 to 10,000 square miles. However, information was also provided on other important storm factors, such as their shape, orientation, movement, and time distribution characteristics. (Humphreys-ISWS) W80-01009

MAP SKEW,

Maryland Univ., College Park. Dept. of Civil En-For primary bibliographic entry see Field 2E.

PRE-MONSOON RAINFALL AND ITS VARI-ABILITY IN BANGLADESH: A TREND SUR-FACE ANALYSIS,

Windsor Univ. (Ontario). Dept. of Geography. M. Sanderson, and R. Ahmed. Hydrological Sciences Bulletin, Vol 24, No 3, p 277-287, September 1979. 9 Fig. 1 Tab, 9 Ref.

Descriptors: \*Monsoons, \*Rainfall,
\*Precipitation(Atmospheric), Variability, Surfaces,
Foreign countries, Foreign research, Surface
drainage, Agriculture, Crops, Foods,
Watersheds(Basins), \*Trend surface analysis, \*Bangladesh, Food crisis, Inventory, Crop acreage.

Bangladesh, with its amall but rich agricultural land (total area 9 million ha) and large population (80 million), is faced with an acute food crisis. The economy of Bangladesh is dependent mainly upon agriculture which, in turn, is dependent upon rainfall. An increase in crop acreage and productivity during the pre-monsoon season, March to May, offers a partial solution to the problem. The water available from the rainfall of this season could be utilized through proper planning for better acricultured. available from the rainfail of this season could be utilized through proper planning for better agricultural uses. The present study was an attempt at an inventory of such pre-monsoon rainfall, both monthly and seasonally, and its variability over time and space. The technique employed was that of trend surface mapping. (Roberts-ISWS) W80-01032

PARTIAL DROUGHT CONDITIONS IN NEPAL,

Ground Water Resources Development Board, Kathmandu (Nepal).

C. K. Sharma. Hydrological Sciences Bulletin, Vol 24, No 3, p 327-333, September 1979. 5 Fig, 10 Ref.

Descriptors: \*Droughts, \*Monsoons, \*Climates, Mountains, Precipitation(Atmospheric), Moisture, Soil erosion, Silting, Landslides, Foreign countries, Foreign research, \*Partial droughts, \*Nepal, \*India, \*Himalayas, Westerlies, Winter precipitation, Westerly rainfalls, Deforestation, Famine.

Partial drought conditions are found in space and time in the mountainous country of Nepal, a land-locked country situated in the middle of the Hima-laya Mountains. This area experiences monsoons in July and the westerlies in January, but even when the winter precipitation comes on time, the planted the winter precipitation comes on time, the planted wheat crop can not give a sufficient yield as the moisture in the soil dries up very fast before the crop matures. Only artificial irrigation by canal or groundwater developments can combat drought in Nepal. At some places, hot winds and dust storms are frequent, and some areas of Nepal are in the grip of drought between the end of March and the beginning of the monsoon in July. Sometimes wells are dry and drinking water is a problem. The main solution to drought in Nepal is the conservation of water resources and the reduction of evaporation from the soil as well as evaporation from reserwater resources and the reduction of evaporation from the soil as well as evaporation from reservoirs. No means to achieve these results were suggested, although it was thought that the development of groundwater resources could combat a continuous drought for a period of two to three years. (Roberts-ISWS) RADAR MEASUREMENT OF RAINFALL-A SUMMARY,

SUMMARY, National Center for Atmospheric Research, Boul-der, CO. J. W. Wilson, and E. A. Brandes. Bulletin of the American Meteorological Society, Vol. No. 9, p. 1048-1058, September 1979. 6 Fig, 3 Tab, 78 Ref.

Descriptors: "Rainfall, "Radar, "Remote sensing, Reviews, Precipitation(Atmospheric), Rain gages, On-site investigations, Theoretical analysis, Sam-pling, Statistics, Statistical methods, Storms, Thun-derstorms, Flash floods, Measurement, Calibra-tions, Meteorology, Radar-rainfall relationships.

Radar can produce detailed precipitation informa-tion for large areas from a single location in real time. Although radar has been used experimentally for nearly 30 years to measure rainfall, operational for nearly 30 years to measure rainfall, operational implementation has been slow. Today, data are underutilized, and both confusion and misunderstanding exist about the inherent ability of radar to measure rainfall, about factors that contribute to errors, and about the importance of careful calibration and signal processing. Areal and point rainfall estimates are often in error by a factor of 2 or more. Error sources reside in measurement of esumates are often in error by a tactor of 2 of radar reflectivity factor, evaporation and advection of precipitation before reaching the ground, and variations in the drop-size distribution and vertical air motions. Nevertheless, radar can be of lifesaving usefulness by alerting forecasters to the potential for flash flooding. The most successful technique for improving the radar rainfall estimates has been to 'calibrate' the radar with rain gages. Simple techniques that combine sparse gage reports (one gage per 1000-2000 sq km) with radar produce smaller measurement errors (10-30%) than either system alone. When high accuracy rainfall measurements are needed (average error less than about 10-20%), the advantage of radar is diminished since the number of gages required for calibration is itself sufficient to provide the desired accuracy. (Sims-ISWS)

THE FRONTIERS PLAN: A STRATEGY FOR USING RADAR AND SATELLITE IMAGERY FOR VERY-SHORT-RANGE PRECIPITATION

FORECASTING, Royal Signals and Radar Establishment, Malvern (England). Radar Research Lab. K. A. Browning. The Meteorological Magazine, Vol 108, No 1283, p 161-184, June 1979. 6 Fig, 16 Ref.

\*Weather forecasting. Descriptors: \*Precipitation(Atmospheric), \*Radar,
\*Satellites(Artificial), Rainfall, Storms, Remote sensing, Forecasting, Data processing, Computers, Data collections, Weather, Meteorology, \*Eng-

The FRONTIERS program described in this article addresses the problem of analyzing and forecasting the detailed pattern of precipitation over the period 0-6 hours ahead. The acronym FRONTIERS embodies the following key elements: Forecasting Rain Optimized using New Techniques of Interactively Enhanced Radar and Satellite. In this program, a whole-system design approach was adopted, with digital data handling all the way from the observational input to the disseminated forecast product. The crucial role of human judgement which is required to make up for the limitations of the observational data and the incompleteness of our understanding on the mesocale was emphasized. In the plan discussed here, the data from a network of radars and a geostationary satellite are composited on an interactive video display, and the forecaster does his analysis and forecasting by modifying what is on the television screen while preserving the basic data in store. The resulting screenful of digital information can then be tailored and disseminated promptly to users without further manual effort. Although the emphasis in this paper was on the accurate analysis of current weather and extrapolation of current trends, these methods must be considered in the context of an eventual forecast system incorporating a mesoscale numerical model. (Sims-15WS)

W80-01038

### 2C. Snow, Ice, and Frost

GLACIER SURVEYS IN BRITISH COLUMBIA-

Department of the Environment, Ottawa (Ontario). Water Quality Branch.

I. A. Reid, and J. O. G. Charbonneau.
Report Series No 63, 1979, 21 p, 10 Fig, 5 Maps, 35 Tab, 9 Ref.

Descriptors: \*Glaciers, \*Surveys, \*Streamflow, \*Surface drainage, \*Water resources, Mapping, Data collections, \*British Columbia, Sentinel Glacier, Sphinx Glacier, Nadahini Glacier, Kokanee Glacier, Bugaboo Glacier, Photogrammetric survey techniques survey techniques.

Glaciers act as natural regulators, storing water in winter and releasing it in summer. To gain some understanding of this phenomenon and the contribution which glaciers make to streamflow, the predecessors of the Water Survey of Canada began glacier surveys in 1945. The earlier surveys offered some clue to the role of the glacier, but the data collected were not sufficient to provide the overall picture. Following adoption of photogrammetric survey techniques, however, the glacier surveys have evolved to the extent that it is now feasible to produce a series of maps from which the linear, areal, directional and volumetric changes can be determined. The surveys have revealed that the glaciers, in general, are becoming smaller in size; hence the regulating effect on streamflow is diminishing. (WATDOC)

### 2D. Evaporation and Transpiration

AN IMPROVED AERODYNAMIC EVAPORA-TION TECHNIQUE FOR LARGE LAKES WITH APPLICATION TO THE INTERNATIONAL FIELD YEAR FOR THE GREAT LAKES, National Oceanic and Atmospheric Administra-tion, Ann Arbor, MI. Great Lakes Environmental

Research Lab

Water Resources Research, Vol 15, No 4, p 935-940, August 1979. 2 Fig, 6 Tab, 18 Ref.

Descriptors: \*Lake Ontario, \*Evaporation, \*Great Lakes, Technology, Mass transfer, Lakes, Winds, Bulk density, Boundary layers, Air-water inter-faces, \*Aerodynamic evaporation technique, \*Lake Hefner, International Field Year, Bulk transfer technique, Bulk transfer coefficient, Wind speed gradient, Mass transfer equation.

An improved bulk transfer technique was developed for large-lake evaporation. The technique is based upon recent boundary layer research near the air-water interface. A variable bulk transfer coefficient, dependent upon atmospheric stability, is given as a function of the nondimensional wind speed gradient, the potential temperature gradient, and the Monin-Obukhov length. The technique, which requires the same data as the simplified mass transfer equation, can be applied to large lakes throughout the world. This technique was applied to the Lake Ontario data set collected during the International Field Year for the Great Lakes. The inclusion of stability increased calculated evaporainternational Field Year for the Great Lakes. The inclusion of stability increased calculated evaporation during the unstable high-evaporation months and decreased calculated condensation during the stable late spring months to more realistic levels. Comparisons between the Lake Hefner mass transfer equation and the tobactory recommended to comparisons between the Lake Heiner mass transfer equation and the technique recommended here indicated that the mass transfer equation may have overestimated Lake Ontario evaporation by approximately 20%. (Roberts-ISWS) W80-01029

### 2E. Streamflow and Runoff

EARLY FLOOD WARNING SYSTEM, A. R. Permut, A. A. Permut, and R. M. Permut. U.S. Patent No 4,153,881, 13 p, 4 Fig, 4 Ref;

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### Streamflow and Runoff-Group 2E

Official Gazette of the United States Patent Office, Vol 982, No 2, p 744, May 8, 1979.

Descriptors: "Patents, "Warning systems, "Flood forecasting, "Electronic equipment, Remote control, Gages, Water level, Data processing, Hazards, Rainfall, Radio communication systems, Flash floods, Early flood warning system.

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An Early Flood Warning System provides advanced warning of probable flash floods and/or stage floods to potential flood victims by collecting and analyzing rainfall and stream level data, and by and analyzing rainfall and stream level data, and by providing means for disseminating alarms and instructions to individuals in threate alarms and instructions to individuals in threatened areas. The Early Flood Warning System contains: automatic electronic digital liquid level gauges, some of which are specially adapted as stream level gauges; gauge actuated transmitters; a receiver; a decoder and validity logic unit; a data analysis unit; a central disaster alert station; and a number of disaster alert modules. The digital liquid level gauges are energy and environmental intensive devices which electronically measure, using digital techniques, liquid levels such as rainfall and stream level, and transmit data by coded radio frequency (R.F.) signals to a central data analysis facility. The digital liquid level gauges are remotely located and independent of each other. (Sinha-OEIS)

LOW-FLOW CHARACTERISTICS OF WIS-CONSIN STREAMS AT SEWAGE-TREAT-MENT PLANTS AND INDUSTRIAL PLANTS, Geological Survey, Madison, WI. Water Resources Div.

B. K. Holmstrom B. K. Holmstrom. Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 688, Price codes: A06 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-31, March 1979. 123 p, 2 Fig, 32 Tab, 36 Ref.

Descriptors: \*Low flow, \*Streamflow, \*Flow characteristics, \*Base flow, \*Wisconsin, Sewage effluents, Industrial wastes, Water quality standards, Gaging stations, Low-flow frequency, Low-flow partial-record stations.

Low-flow characteristics of Wisconsin streams at sewage-treatment and industrial plants are presented. The low-flow characteristics are needed to implement water-quality standards for all surface waters of the State. Water-quality standards in Wisconsin are based on the annual minimum 7-day mean flow below which the flow will fall on the average of once in 10 years (Q7,10). Low-flow characteristics are included for streams at 397 sewage-treatment plants and 143 industrial plants in 30 river basins. The low-flow characteristics are included for streams at 397 sewage-treatment plants and 143 industrial plants in 30 river basins. The low-flow characteristics are included for streams at 397 of the plants of the stream of the sewage of once in 2 years (Q7,2) and the Q7,10. The Q7,2 values ranged from 0 to 3,770 cubic feet per second and Q7,10 values ranged from 0 to 2,790 cubic feet per second. (Woodard-USGS)

ASSESSMENT OF FITTING TECHNIQUES FOR THE LOG PEARSON TYPE 3 DISTRIBUTION USING MONTE CARLO SIMULATION, Queen's Univ., Kingston (Ontario).

M. J. Nozdryn-Plotnicki, and W. E. Watt. Water Resources Research, Vol 15, No 3, p 714-718, June 1979. 4 Fig, 1 Tab, 10 Ref.

Descriptors: \*Flood frequency, \*Probability, \*Annual peak discharge, \*Methodology, \*Stochas-tic hydrology, Monte Carlo method, Statistical models, Analytical techniques, Model studies, \*Log Pearson type 3 distribution, \*Skewness, Gen-eration algorithm, Statistical efficiency, Maximum likelihood method, Method of moments.

The distribution parameter space, as defined by annual maximum floods at 37 long-term Canadian flow-gaging stations, was used to derive log Pearson type 3 independent variates. The generated variates were divided into sets of 25-, 50-, and 100-year samples. For each sample, parameters and specific recurrence-interval floods were estimated

by using three techniques: the method of maximum likelihood, the method of moments, and a method which preserves the moments of the untransformed flows. The parameter estimates were generally very poor; they were highly biased and exhibited large variances. However, there was no significant bias in 50- and 100-year flood estimates. On the basis of statistical efficiency, no one method was superior for the whole of the parameter space. The exressions for the standard error of the T-year flood were found to be biased for N equal to 25, 50, and 100 years. In general, the asymptotic maximum of the property of the standard error of the standard error of the T-year flood were found to be biased for N equal to 25, 50, and 100 years. In general, the asymptotic maximum 50, and 100 years. In general, the asymptotic maximum likelihood relation gave underestimates, whereas the moments relation gave overestimates.

ESTIMATION OF DRAINAGE DENSITY FROM TOPOLOGICAL VARIABLES, Leicester Univ. (England). Dept. of Geography.

V. Gardiner. Water Resources Research, Vol 15, No 4, p 909-917, August 1979. 5 Fig. 8 Tab, 42 Ref.

Descriptors: "Geomorphology, "Drainage density, 
"Model studies, Sampling, Drainage, Geology, 
Hydrology, Watersheds(Basins), Estimating, 
Streams, Mathematical studies, "Stream networks, 
"Devon(England), "England, Grid square drainage 
density, Principal component analysis, Land form,

Existing methods for the estimation of drainage density are generally inadequate, being either laborious or expensive or of low effectiveness. Methods were examined by which grid square drainage density may be estimated from topological variables; a sample of 400 grid squares from Devon, England, was used in the study. Principal components analysis of these data yields interpretable components that allow prediction of 82% of the total variation in stream length, employing a multiple relationship. A simple regression relationship affords prediction of 68% of the variation in stream length. The mode of sampling employed and the use of polynomial regression do not markedly change the effectiveness of these relationships, and sufficient published work exists to suggest that the method may be widely applicable. (Lee-ISWS)

EXPERIMENTS IN LONGITUDINAL DISPER-SION WITH DEAD ZONES, Ministry of Works and Development, Wellington (New Zealand). For primary bibliographic entry see Field 8B. W80-00973

PRELIMINARY IDENTIFICATION OF PRICE RIVER BASIN SALT PICK-UP AND TRANS-PORT PROCESSES, Utah State Univ., Logan. Dept. of Civil and Envi-

ronmental Engineering.
For primary bibliographic entry see Field 2J.

TRANSFER COEFFICIENTS IN STRATIFIED CHANNEL FLOW, Nevada Univ. System, Las Vegas. Desert Re-

ch Inst.

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY9, Proceedings Paper 14808, p 1087-1101, September 1979, 7 Fig. 2 Tab, 18 Ref, 2 Append.

Descriptors: \*Stratified flow, \*Open channel flow, \*Turbulent flow, \*Laboratory tests, Model studies, Hydraulic models, Flumes, Density stratification, Saline water-freshwater interfaces, Flow, Shear, Turbulence, Transfer, Water transfer, Mixing, Equations, Theoretical analysis, Transfer coeffi-

Empirical equations based on laboratory data were developed to predict the turbulent momentum and solute transfer coefficients in stratified open channel flows. In flows where the primary source of

turbulence was the bottom boundary and the density stratification was continuous, a high degree of correlation was found to exist between the momentum transfer coefficient and a bulk Richardson number based on the shear velocity, the depth of flow, the average density, and the maximum change in density across the flow. The degree of change in density across the llow. Ine degree of correlation between the solute transfer coefficient and this Richardson number was not as high. Al-though several limitations were noted, the work represents an improvement over alternative the-ories. (Sims-ISWS) W80-01022

ESTIMATING AVERAGE VELOCITY IN GRAVEL-BED RIVERS, New Brunswick Univ., Fredericton. Dept. of Civil Engineering.

Engineering.
D. I. Bray.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY9, Proceedings Paper 14810, p 1103-1122, September 1979. 3 Fig. 6 Tab, 19 Ref.

Descriptors: \*Channels, \*Gravels, \*River beds, Estimates, Friction, Rivers, Hydraulics, Roughness(Hydraulic), Streamflow, Velocity, Onsite investigations, \*Fluvial hydraulics, Computa-

Basic data from 67 gravel bed river reaches in Alberta, Canada, were used to test widely adopted equations for computing average velocity in natural channels for the case of relatively high in-bank flows. Relations proposed by Cowan, Strickler, and Limerinos to estimate Manning's n were and Limerinos to estimate Manning's n were tested. The equations of the form presented by Keulegan and Lacey for computing average veloc-ity also were evaluated. Computations based on these methods indicated that the Limerinos-Manning equation is the most acceptable approach for estimating average velocity in gravel-bed river reaches. The Lacey equation provides satisfactory results if no bed material data are available. The basic data also were used to develop best-fit rela-tionships for computing Manning's n and the fric-tion factor for gravel-bed river reaches. Particular remphasis was placed on an evaluation of the sig-nificance of bed material data in equations used to compute average velocity in gravel-bed river reaches. (Lee-ISWS) W80-01023

HYDROLOGIC GENERATING MODEL SE-

LECTION, Waterloo Univ. (Ontario). Dept. of Systems

Design.
K. W. Hipel, E. A. McBean, and A. I. McLeod.
Journal of the Water Resources Planning and Management Division, American Society of Civil Engineers, Vol 105, No WR2, Proceedings Paper
14817, p 223-242, September 1979. 2 Fig, 2 Tab, 45
Ref, 2 Append.

Descriptors: \*Mathematical models, \*Canada, \*River flow, \*Reservoir design, Model studies, Stochastic processes, Simulation analysis, Flow, Rivers, Reservoirs, Costs, Cost-benefit analysis, Decision making, Planning, Hydrology, \*South Saskatchewan river(Canada).

When modeling seasonal river flows for generating possible flow sequences for use in reservoir design, it is often necessary to first invoke a deterministic it is often necessary to first invoke a deterministic transformation to remove seasonality, and thus eliminate the need for differencing. To select which stationary stochastic model to fit to the resulting transformed data, a two-stage decison-making process was recommended. The first stage consists of eliminating those models which do not possess a proper statistical fit to the data, while further discrimination can be done at the second further discrimination can be done at the second stage by judging the remaining models according to the economic criteria of the particular reservoir design. Simulation procedures were used to obtain designs using various hydrologic generating models for a hydroelectric reservoir complex on the South Saskatchewan River in Canada. Both Box-Jenkins and Fractional Gaussion noise processes were considered in the model selection studies. A new simulation procedure was developed

### Field 2-WATER CYCLE

### Group 2E-Streamflow and Runoff

for use with a Fractional Gaussian noise model. (Sims-ISWS) W80-01025

MAP SKEW, Maryland Univ., College Park. Dept. of Civil En-

R. H. McCuen.
Journal of the Water Resources Planning and Management Division, American Society of Civil Engineers, Vol 105, No WR2, Proceedings Paper 1840, p 269-277, September 1979. 2 Fig, 3 Tab, 4 Ref, 1 Append.

Descriptors: "Flood frequency, "Runoff, "Statistical analysis, Floods, Mapping, Statistics, Excessive precipitation, Precipitation(Atmospheric), Rainfall, Hydrographs, Climatology, Hydrology, "Skew-

Flood frequency estimation using the recommend-ed log-Pearson type III analysis requires an esti-mate of the skew coefficient. The sample estimate of skewness may be inaccurate when the record length is small. A generalized estimate obtained using regional data provides an alternative esti-mate, the accuracy of which is difficult to evaluate. An analysis of the standard error of estimate of the skew map recommended in the Water Resources Council in Bulletin 17 was shown to be relatively large and not significantly different from the standlarge and not significantly different from the stand-ard error of estimates obtained from annual flood ard error or estimates obtained from annual flood series. A weighted estimate of the skew coefficient should provide more accuracy, providing that the weighting scheme is designed to minimize the error variance. (Sims-ISWS) W80-01026

URBAN RUNOFF POLLUTION METHOD, GKY and Associates, Inc., Alexandria, VA. For primary bibliographic entry see Field 5B. W80-01027

FORCED FORTNIGHTLY TIDES IN SHALLOW RIVERS,

British Columbia Univ., Vancouver. Dept. of Oceanography

P. H. LeBlond Atmosphere-Ocean, Vol 17, No 3, p 253-264, 1979. 6 Fig. 1 Tab, 9 Ref.

Descriptors: \*Rivers, \*Tides, \*Water levels, \*St. Lawrence River, Shallow water, Water level fluctuations, Theoretical analysis, Mathematical studies, Mathematical models, Model studies, Runoff, Tidal effects, Sea level.

The presence and the basic features of the forced fortnightly wave observed in some shallow rivers were explained through scaling arguments which showed that this wave is generated by the fort-nightly modulation of the frictional forces due to the variation in tidal velocities. Comparison of the results with sea level records from a shallow reach of the St. Lawrence River showed reasonable agreement between data and theory. (Sims-ISWS) W80-01031

### 2F. Groundwater

DISTRIBUTION OF GROUND-WATER WITH-DRAWALS ON LONG ISLAND, NEW YORK, IN 1973 BY AREA, AQUIFER, AND USE, Geological Survey, Syosset, NY. Water Resources

F. Erlichman. Long Island Water Resources Bulletin 10, 1979. 16 p, 6 Fig, 1 Plate, 2 Tab, 18 Ref.

Descriptors: \*Groundwater, \*Water supply, \*Withdrawal, \*Water utilization, \*Aquifers, Water demand, Land development, Water distribution(Applied), Maps, \*Long Island(NY).

Use of ground water on Long Island has increased dramatically with continued eastward urbanization and population growth. Annual total ground-water withdrawals for all uses have increased steadily

since the 1880's to 496 million gallons per day (Mgal/d) in 1973. Public-supply withdrawals in 1973 accounted for 75 percent of this total; commercial-industrial withdrawals accounted for 23 percent, and agricultural withdrawals 2 percent. Total withdrawals on Long Island more than doubled between 1940 and 1973, from about 220 to 496 Mgal/d. From 1992 to 1973, public-supply withdrawals increased by more than 50 percent, from 144 to 374 Mgal/d: most of this increase was from the Magothy aquifer. Pumping density decreases eastward, in direct proportion to population density. The greatest pumping density is in urban Queens County; the smallest is in eastern Suffolk County. The greatest rate of increase in groundwater withdrawals today (1973) on Long Island is in western and creatral Suffolk County, where development and urbanization are taking place at the in western and creatral surious County, where de-velopment and urbanization are taking place at the fastest rate. Withdrawals during 1973 are reported by use, county, and source aquifer. Maps showing areal distribution of public-supply withdrawals by source aquifer in 1973 and 1932 are included for comparison. (Woodard-USGS) W80-00922

GROUND-WATER CONDITIONS IN THE EUREKA AREA, HUMBOLDT COUNTY, CALIFORNIA, 1975,

Geological Survey, Menlo Park, CA. Water Resources Div.

M. J. Jonnson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 577, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-127, December 1978. 45 p, 9 Fig, 6 Tab, 36 Ref.

Descriptors: \*Groundwater resources, \*Water wells, \*Aquifers, \*Water yield, \*Water quality, Water utilization, Water supply, Groundwater availability, Water levels, Hydrogeology, Groundwater recharge, Surface-groundwater relationships, Saline water-freshwater interfaces, \*California, \*Humboldt County(CA), \*Eureka Area(CA).

Ground-water conditions in the Eureka area, Calif., were evaluated during 1975 to determine whether significant changes had occurred since 1952, when an earlier reconnaissance was made. No major changes in water levels or water quality were noted at 1975 pumping rates. Recharge to the ground-water system compensates for both artificial and natural discharge. The position of the freshwater-saltwater transition zone underlying the alluvial flood plains in the summer of 1975 were unchanged from those in 1952. Ground water conunchanged from those in 1952. Ground water continues to be used principally for irrigation on the alluvial flood plains of the Eel and Mad Rivers. In 1975, about 425 irrigation wells supplied an estimated 24,000 acre-feet of ground water to the Eureka area; half of those wells were located on the Eel River flood plain. The estimated total ground-water pumpage for irrigation, industry, public supply, domestic use, and livestock was 27,500 acre-feet. During the irrigation season, there is a higher rate of recharge from the rivers which helps to maintain ground-water storage and stabilize the freshwater-seawater transition zone. (Woodard-USGS) dard-USGS) W80-00926

MAPS SHOWING GROUND-WATER CONDI-TIONS IN THE NEW RIVER-CAVE CREEK AREA, MARICOPA AND YAVAPAI COUN-TIES, ARIZONA-1971,

Geological Survey, Tucson, AZ. Water Resources

For primary bibliographic entry see Field 7C.

CONFIGURATION OF THE TOP OF THE FLORIDAN AQUIFER, SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT AND ADJACENT AREAS, Geological Survey, Tallahassee, FL. Water Re-

For primary bibliographic entry see Field 7C. W80-00934

4

A DIGITAL MODEL FOR SIMULATION OF GROUND-WATER HYDROLOGY IN THE HOUSTON AREA, TEXAS, Geological Survey, Houston, TX. Water Re-sources Div.

For primary bibliographic entry see Field 6A. W80-00935

GROUNDWATER LEVELS IN NEBRASKA,

1978,
Nebraska Univ., Lincoln. Div. of Conservation and Survey; and Geological Survey, Lincoln, NE. Water Resources Div. D. T. Pederson, and M. S. Johnson.
Nebraska Water Survey Paper No 49 July 1979.

116 p, 25 Ref.

Descriptors: \*Groundwater, \*Water wells, \*Water level fluctuations, \*Nebraska, Hydrographs, Water table, Withdrawal, Groundwater recharge, Obser-

This report summarizes data about groundwater-level changes in Nebraska during 1978 and in-cludes other information pertinent to the water-level measurement program. The amounts of change from predevelopment water levels are shown on maps, and hydrographs are used to show trends in water-level changes. Also described are availability of data on water levels, changes in the water-level measurement program during the year, and the two major causes of water-level changes-recharge from precipitation and withdrawal of ground water. (Woodard-USGS) W80-00936

STRATIGRAPHIC AND HYDROGEOLOGIC FRAMEWORK OF PART OF THE COASTAL PLAIN OF TEXAS,

Geological Survey, Austin, TX. Water Resources

Div. E. T. Baker Jr. Texas Department of Water Resources Report 236, July 1979. 43 p, 1 Fig, 1 Tab, 34 Ref.

Descriptors: \*Stratigraphy, \*Hydrogeology, \*Geologic mapping, \*Aquirers, \*Texas, Coastal plains, Geologic units, Geologic time.

The subsurface delineation of hydrogeologic units of Miocene and younger age and stratigraphic units of Paleocene to Holocene age establishes an units of Paleocene to Holocene age establishes an interrelationship of these units statewide across much of the Coastal Plain of Texas. The 11 dip sections and 1 strike section, which extend from the land surface to 7,600 feet below sea level, provide continuity of correlation from the outcrop to the relatively deep subsurface. Sand containing water with less than 3,000 milligrams per liter of dissolved solids, which is shown on the sections, serves as an index of water availability of this quality. (Woodard-USGS)

GEOHYDROLOGY OF BROOKS, LOWNDES, AND WESTERN ECHOLS COUNTIES, GEOR-

GEOHYDROLOGY OF BROOKS, LOWNDES, AND WESTERN ECHOLS COUNTIES, GEOR-GIA, Geological Survey, Doraville, GA. Water Re-sources Div. R. E. Kraus

Geological Survey Water-Resources Investigations 78-117 (open-file report), June 1979. 48 p, 18 Fig, 8 plates, 2 Tab, 39 Ref.

Descriptors: "Hydrogeology, "Groundwater resources, "Water quality, "Aquifer characteristics, "Surface-groundwater relationships, Artesian aquifers, Water wells, Water yield, Groundwater recharge, Karst, Water level fluctuations, Water analysis, Chemical analysis, Hardness(water), Iron, Strontium, Specific conductivity, Hydrogen sulfide, Sulfates, Color, Georgia, "Valdosta area(Ga).

The principal artesian aquifer, a limestone of Eocene to Miocene age, is the main source of water supply for Brooks, Lowndes, and western Echols Counties in south Georgia. Pumpage of about 22 million gallons perday from this prolific aquifer has not posed any problems regarding declining water levels or depletion of the reservoir.

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### Groundwater-Group 2F

However, water-quality problems do occur in the Valdosta area. Seepage-run measurements indicate that the Withlacoochee River north of Valdosta contributes an average of 112 cubic feet per second of water to caverns and sinkholes that recharge the aquifer. Wells near the recharge area withdraw relatively unfiltered water with iron concentration and color intensity exceeding standards for drinking water. South of Valdosta, water from the aquifer contains as much as 3.0 milligrams per liter of hydrogen sulfide, rendering the water unfit for drinking. Water high in sulfate concentration occurs below 550 feet in the lower part of the aquifer in Valdosta, and is assumed to be present at that depth throughout the study area. Generally, sufficient quantities of freshwater can be obtained without drilling to this depth. (Woodard-USGS) W80-00941

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PUBLIC GROUNDWATER SUPPLIES IN CAR-ROLL COUNTY, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 7C. W80-00946

UNSTEADY FLOW IN CONFINED AQUIFERS: A COMPARISON OF TWO BOUNDARY INTE-GRAL METHODS, Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
J. A. Liggett, and P. L.-F. Liu.
Water Resources Research, Vol 15, No 4, p 861-866, August 1979. 7 Fig. 11 Ref.

Descriptors: \*Unsteady flow, \*Analytical techniques, \*Groundwater, \*Model studies, Numerical analysis, Aquifers, Artesian aquifers, Mathematical models, Equations, 'Integral equations, Laplace

The boundary integral equation method (BIEM) was used for the solution of unsteady flow in confined aquifers. Such flows were described by a contined aquiters. Such nows were described by a diffusion equation. Two approaches were presented. The first method removed the time derivatives with a Laplace transform first and solved an associated equation with the BIEM for several values of the transform parameter. A numerical transform inversion was then used to express the results in inversion was then used to express the results in physical terms. The second method solved the differential equation directly with the BIEM. Both of these techniques were compared to the exact solutions of two simple problems. The Laplace transform method was found to be superior for general use, although the direct method was simpler and required less judgment on the part of the analyst. (Adams-ISWS) W80-00949

PERSPECTIVE ON 'DELAYED YIELD',
Arizona Univ., Tucson. Dept. of Hydrology and
Water Resources.

Water Resources' S. P. Neuman. Water Resources' Research, Vol 15, No 4, p 899-908, August 1979. 1 Fig, 38 Ref.

Descriptors: \*Specific yield, \*Water table aquifers, \*Theoretical analysis, \*Drawdown, \*Storage coef-ficient, Aquifers, Mathematical models, Equations, Graphical analysis, Curves, Equations, Wells, Water table, \*Delayed yield.

The phenomenon of 'delayed yield' has received wide attention in the literature during recent years. Considerable work has been devoted to the development of physically based mathematical models capable of successfully reproducing observed aquifer behavior. As a result of this effort, there aquifer behavior. As a result of this effort, there appears to be at present a consensus of opinion among the main contributors to the theory of delayed yield as to an acceptable physical and mathematical interpretation of this phenomenon. In spite of this apparent consensus of opinion, there is still a considerable amount of controversy in the literature about some fundamental aspects of unconfined well hydraulics. The outstanding issues concern the physical assumptions underlying various delayed yield models, changes in the flow regime of an unconfined aquifer as a function of radial distance from the pumping well, the relaradial distance from the pumping well, the rela-

tionship between Boulton's alpha and other physical characteristics of the aquifer, the validity of conditions required in order to represent unconfined flow by integrodifferential equations, and the behavior of unconfined aquifers at large values of time. The present paper offered a perspective on these and other related issues. (Visocky-ISWS) W80-00952

INFLUENCE OF COVER SLAB DIAMETER ON SOLUTE TRAVEL TIME TO WELLS, Iowa State Univ., Ames. Dept. of Agronomy. D. Kirkham, and M. O. Sotres. Water Resources Research, Vol 15, No 4, p 941-948, August 1979. 5 Fig. 2 Tab, 6 Ref, 2 Append.

Descriptors: \*Travel time, \*Solutes, \*Ground-water movement, \*Water wells, Steady flow, Ob-servation wells, Water table aquifers, Flow nets, Potential flow, Hydraulic conductivity, Pollutants, Mathematical models, Equations, Model studies,

Travel times were computed for solute, moving by assumed piston flow, in steady state along streamlines in a phreatic (water table) aquifer in which a tube well is located to determine the influence of a lines in a phreatic (water table) aquifer in which a tube well is located to determine the influence of a well cover slab on the travel times. Flow nets were first computed by potential theory; then travel times along sets of streamlines were derived for 12 geometries. Parameters were cover slab radius, screened and unscreened casing depth, thickness of aquifer, well radius, and radius of influence. For example, for a well of cover slab radius 1.8 m, screened casing depth 0.5 m, unscreened casing depth 1.5 m, thickness of aquifer 6 m, well radius 0.6 m, and radius of influence 30 m, hydraulic conductivity 35 m/d, head difference across the system 0.15 m, and aquifer porosity 0.25, the travel time for solute injected at the edge of the cover slab to reach the well is 5.4 days, whereas solute introduced at the top of the aquifer next to the well pipe with no cover slab is 0.17 day (4.1 hours). The longer travel time, 5.4 days versus 0.17 day for 'no cover slab,' provides a longer time for biochemical and biophysical degradation of the solute, which may be pollutants as nitrates and acids originating from agriculture, industry, strip mines, sanitary landfills, or other groundwater pollution sources near a well. (Visocky-ISWS) W80-00955

A NEW NUMERICAL METHOD FOR SOLV-ING THE SOLUTE TRANSPORT EQUATION, Analytic Sciences Corp., Reading, MA.
B. Ross, and C. M. Koplik.
Water Resources Research, Vol 15, No 4, p 949-955, August 1979. 6 Fig, 1 Tab, 13 Ref. DOE W-7405-ENG-48.

Descriptors: \*Groundwater movement, \*Solutes, \*Pollutants, \*Path of pollutants, Groundwater, Water pollution, Model studies, Mathematical models, Numerical analysis, Porous media, Subsurface flow, Subsurface waters, Waste disposal, Hydrology, \*Solute transport.

The solute transport equation can be solved numerically by approximating the water flow field by a network of stream tubes and using a Green's function solution within each stream tube. Compared to previous methods, this approach permits greater computational efficiency and easier representation of small discontinuities, and the results are easier to interpret physically. The method has been used to study hypothetical sites for disposal of high-level radioactive waste. (Sims-ISWS)

SOIL WATER HYSTERESIS AS A CAUSE OF DELAYED YIELD FROM UNCONFINED AQUIFERS,

Science and Education Administration, Phoenix, AZ. Water Conservation Lab.

Water Resources Research, Vol 15, No 4, p 965-966, August 1979. 1 Fig, 9 Ref.

Descriptors: \*Hysteresis, \*Specific yield, \*Water table aquifers, Moisture content, Soil water, Stor-

age coefficient, Capillary action, Water table, Aquifers, Wells, Pumping, Vadose water, \*De-layed yield.

Hysteresis in the relation between soil water content and (negative) pressure head of the soil water produces a lag in the release of pore water from a rewetted soil when the pressure heads are lowered (made more negative). For an unconfined aquifer, this means that the water table must drop some distance in response to pumping a well before pore water is fully released, if the water table prior to pumping had been rising. Since water tables around active wells usually have been rising before a pumping test is performed (to establish equilibrium), soil water hysteresis may well be a common cause of delayed yield from unconfined aquifers. (Visocky-ISWS)

THE EFFECTS OF URBANIZATION ON GROUND-WATER QUALITY—A CASE STUDY, Wisconsin Univ. -Madison. Dept. of Geology and For primary bibliographic entry see Field 5B. W80-00965

PREVALENCE OF ENTEROVIRUSES IN GROUND WATER OF ISRAEL,
Ministry of Health, Tel Aviv (Israel). Central Virus Lab.

For primary bibliographic entry see Field 5A. W80-00966

AQUIFER DIFFUSIVITY FROM NOISY BOUNDARY DATA, Arizona Univ., Tucson. Dept. of Hydrology and

Descriptors: \*Aquifers, \*Diffusivity, \*Statistical analysis, \*Mathematical models, Model studies, Groundwater, Streams, Boundary processes, Data processing, Statistics, Stochastic processes, Hydraulic gradient, Water levels, Water resources, Error analysis.

In this paper, the statistical properties of diffusivity were worked out from certain assumed statistical information on data. Use was made of an explicit information on data. Use was made of an expicit solution described by the writers for diffusivity in a stream-aquifer system with an overspecified boundary condition. It was assumed that both the river stage hydrograph and the hydraulic gradient contain independent Gaussian noise. It was then determined that the diffusivity is the ratio of the course of two independent normal random variasquare of two independent normal random varia-bles. The dependence of mean value and standard deviation of diffusivity on various levels of errors in boundary data was computed and plotted. It was found that while the expected value of diffusivity does not vary much, the standard deviation increases at a fast rate as the errors in data increase. to a max rate as the errors in data increase. It is possible to find limits on errors in data for obtaining diffusivity estimates of certain reliability. (Sims-ISWS) w80-00971

SOME EFFECTS OF GROUNDWATER EXTRACTION IN THE WESTERN PART OF THE NETHERLANDS ON THE HYDROLOGICAL REGIME

Rijksinstituut voor Drinkwatervoorziening, Leidsendam (Netherlands).

G. J. Heij. G. J. Heij.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality.
Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No 123, International Association of Hydrological Sciences, p 167-178, 1977. 7 Fig. 1 Tab, 6 Ref.

Descriptors: \*Groundwater, \*Urbanization, \*Hydrogeology, \*Effects, Infiltration, Withdrawal, Seepage, Land subsidence, Analytical techniques,

### Field 2—WATER CYCLE

### Group 2F-Groundwater

Mathematical models, Groundwater movement, Potentiometric level, Head loss, Hydraulic con-ductivity, Foreign research, \*Hydrologic regime, \*The Netherlands.

In this paper, particular attention was paid to the consequences of lowering the hydraulic head through the extraction of groundwater, while Broeze and Couwenhoven (1977) dealt with the consequences of the lowering of the groundwater table. The influence of the extraction of groundwater of the deep groundwater flow may be calculated with formulas for radial-symmetrical flow. The cutting of the Amsterdam-Rijncanal was used as an example to obtain an impression of the influence on the groundwater regime by cutting a canal and to the consequences of lowering the groundwater head by extraction, such as changes in seepage and infiltration and settlement of semiin seepage and infiltration and settlement of semi-permeable layers. Finally, attention was given to the possibility of reducing or preventing these re-ductions of the groundwater head. Drawdown, as a result of groundwater extraction, among other things, influences seepage or infiltration and settle-ment of semipervious layers, resulting in subsi-dence and an increase of the hydraulic resistance. dence and an increase of the hydraulic resistance. The influence of another activity on the hydrological regime, the cutting of a canal, can make a considerable call on a groundwater reservoir. In view of the increasingly strong confrontation with other interests, intensive investigation is required into the most suitable locations for groundwater extraction. Extracted groundwater which is not consumed must be returned to the soil if possible. In addition to this, continuous attention should be given to other possibilities to satisfy the need of given to other possibilities to satisfy the need of water. (See also W78-08065 and W79-07426 thru W79-07488) (Humphreys-ISWS) W80-00978

NUMERICAL SIMULATION OF MATERIAL TRANSPORT IN A REGIONAL GROUND-WATER FLOW SYSTEM,

California Univ., Livermore. Lawrence Livermore

T. D. Naymik, and L. D. Thorson. Report UCRL-52556, 1978. 23 p, 9 Fig, 5 Tab, 11 Ref.

Descriptors: \*Model studies, \*Groundwater, \*Numerical analysis, \*Mass transfer, \*Flow system, Regional analysis, Porosity, Distribution, Hydraulic properties, Groundwater movement, Equations, Material transport

A numerical model of a regional groundwater flow system (not site specific) was coupled with a mate-rial transport model in order to study the influence of porosity and distribution coefficients in bedded of porosity and distribution coefficients in bedded media. The effects on model performance were discerned from long-term material transport simulations. Model performance was based on initial breakthrough time, average breakthrough time, average breakthrough time, and the standard deviation of the breakthrough curve at a discharge surface. Large differences in model performance occurred when the distribution coefficient was changed less than an order of magnitude, while small differences resulted from changing porosity several orders of magnitude. (Visocky-1SWS)
W80-01042

METHOD AND APPARATUS FOR UTILIZING ACCUMULATED UNDERGROUND WATER IN THE MINING OF SUBTERRANEAN SUL-

PHUR, Freeport Minerals Co., New York. (Assignee). R. L. Williams, R. L. Latiolais, J. L. Gabriel, and R. L. Bouis. U.S. Patent No 4,157,847, 13 p, 5 Fig, 16 Ref; Official Gazette of the United States Patent Office, Vol 983, No 2, p 325, June 12, 1979.

Descriptors: \*Patents, \*Mining, \*Mine water, \*Water reuse, Recycling, Pollution abatement, Sulfur, Water pollution sources, Hot water, Sulfur mining, Energy conservation.

It is the purpose of this invention to recover and re-use the heat of the hot underground water accumulated from ongoing and/or previous sulphur

mining operations without bringing the water to the surface. The invention is especially applicable to the Frasch mining process where hot water having a temperature sufficiently high to liquefy sulphur is pumped underground to contact the subterranean sulphur-bearing ore to heat it and ultimately convert the solid sulphur contained by the ore to liquid sulphur which is then brought to the surface. In heating the sulphur-bearing ore, some of the heat of the hot water is spent and the water is somewhat reduced in temperature but remains hot and accumulates in large quantities underground. The spent hot water remains hot remains hot and accumulates in large quantities underground. The spent hot water remains hot underground because of the insulating nature of the formation which surrounds it. Because of its lower specific gravity compared to liquid sulphur and cooler connate waters the spent hot water rises in the formation, e.g., in the leached or barren zones of the caprock, and accumulates in the upper regions. The invention comprises a method of and apparatus for subterraneanly recycling the accumulated hot water to the lower, sulphur-enriched, productive zones of the formation where it contacts and contributes heat to solid sulphur. (Sinha-OEIS) OEIS) W80-01180

### 2G. Water In Soils

AN INITIAL VALUE PROBLEM FOR THE HORIZONTAL INFILTRATION OF WATER,

Princeton Univ., NJ. Dept. of Civil Engineering. D. K. Babu, and M. Th. Van Genuchten. Water Resources Research, Vol 15, No 4, p 867-872, August 1979. 2 Fig. 22 Ref.

Descriptors: \*Infiltration, \*Soil water movement, \*Mathematical models, Diffusivity, Equations, Moisture content, Finite element analysis, Mathematical studies, Model studies, Perturbation analvsis. Soil columns

An initial value problem for the horizontal infiltra-tion of water was solved by means of a perturba-tion technique. The diffusivity was assumed to vary as a positive power of the normalized water vary as a posture power or the normalized water content. Evolution of the profile was supposed to be taking place in two stages. In the first stage, moisture content at the origin increases steadily as some arbitrary power of dimensionless time until the maximum normalized value of unity is attained; thereafter, in the second stage, moisture content at thereafter, in the second stage, moisture content at the origin remains at the constant value of unity. The moisture distribution at the end of the first stage defines the initial values of moisture for the problem in the second stage. This paper derived the flow details for the second stage and constructed moisture profiles as they evolve for times greater than unity. (Visocky-ISWS) W80-00950

PERSPECTIVE ON 'DELAYED YIELD',
Arizona Univ., Tucson. Dept. of Hydrology and
Water Resources.
For primary bibliographic entry see Field 2F.
W80-00952

SOIL WATER HYSTERESIS AS A CAUSE OF DELAYED YIELD FROM UNCONFINED DELAYED

SCIENCE AND Education Administration, Phoenix, AZ. Water Conservation Lab. For primary bibliographic entry see Field 2F. W80-00959

UNSATURATED WATER FLOW WITHIN POROUS MATERIALS OBSERVED BY NMR IMAGING, University of Manchester Inst. of Science and

University of Manchester Inst. of Science and Technology (England).
R. J. Gummerson, C. Hall, W. D. Hoff, R. Hawkes, and G. N. Holland.
Nature, Vol 281, No 5725, p 56-57, August 30, 1979. 4 Fig, 14 Ref.

Descriptors: \*Porous media, \*Unsaturated flow, \*Nuclear magnetic resonance, \*Laboratory tests, Wetting, Drying, Moisture content, Diffusivity,

Capillary action, Capillary conductivity, Capillary water, Absorption, Analytical techniques, Soil water, Soil science.

Wetting, drying, and permeation processes in various porous materials are of special interest to soil science, agriculture, building science, and chemical engineering. Direct experimental study of unsaturated flow within such materials is hampered by the difficulty of detecting with precision changes in their internal water content distributions. In laboratory work on soils, gravimetric sampling is widely used. However, this is a destructive method which interferes with water flow processes and in any case is not easy to apply accurately to rigid any case is not easy to apply accurately to rigid materials such as permeable rocks, ceramics, and building materials. Gamma-ray attenuation is the only established non-destructive instrumental only established non-destructive instrumental method in laboratory use. This paper reported the first use of a nuclear magnetic resonance (NMR) imaging technique to monitor the dynamics of the internal water content distribution in several porous inorganic materials during capillary inflow. (Sims-ISWS) W80-00963

ERRORS IN DETERMINATION OF THE WATER CONTENT OF A TRICKLE IRRIGATED SOIL VOLUME, Ben-Gurion Univ. of the Negev, Beersheba (Israel). Inst. of Desert Research.

(March, 1986) Desert Research.

J. Ben-Asher.

Soil Science Society of America Journal, Vol 43, No 4, p 665-668, July-August 1979. 3 Fig, 1 Tab, 10 Ref.

Descriptors: \*Soil water, \*Arizona, \*Moisture content, \*Irrigation, On-site data collections, Sampling, Data processing, Statistics, Gravimetry, Bulk density, Soil water movement, \*Yuma(AZ), \*Israel, \*Nahal Sinai(Israel), Error analysis.

A short review of the possible methods of measuring soil water content under high frequency trickle irrigation suggested that the gravimetric method was most appropriate. Three sources of errors in this method were evaluated and discussed. The sources were those of water content by weight, bulk density, and integration based on the sampling grid. Furthermore, as the sampling mesh became larger than the defined standard deviation (SD). Error analysis of measurements on uniform Bet Dagan grumusol and sandy soils of Nahal Sinai (Israel) and Yuma (Arizona) showed that coefficient of variation in volume of water within an irrigated volume element may be reduced if the sampling grid is taken properly. The analysis suggested that for a given coefficient of variation and interval of sampling depth, an optimum distance between lateral samples can be evaluated from a mathematical reorganization of the coefficient of variation. (Sims-ISWS)

LINEARIZED MOISTURE FLOW FROM LINE SOURCES WITH WATER EXTRACTION, Arizona Univ., Tucson. Dept. of Soils, Water and

Engineering.
A. W. Warrick, A. Amoozegar-Fard, and D. O.

Transactions of the American Society of Agricultural Engineers, Vol 22, No 3, p 549-553 and 559, May-June 1979. 4 Fig, 14 Ref.

Descriptors: \*Soil water, \*Soil water movement, \*Flow, \*Irrigation, Model studies, Mathematical models, Theoretical analysis, Soils, Soil-waterplant relationships, Hydraulic conductivity, Moisture uptake, Moisture content, Vegetation, Vegetation effects, Evaporation, Agriculture, Line sources

The linearized moisture flow equation was solved for two-dimensional line sources (buried or on the surface) with water extraction. Linearization was attained in the steady-state case by assuming the unsaturated hydraulic conductivity, K, was exponentially related to the pressure head, h, as K = K sub o exp (alpha h). The water extraction was one-dimensional, while the surface loss was proportional to exp (alpha h). As an aid for design or oper-

ation, ar giving th lines for with or straightfo using a relate pr rooting of The nor Distribu face sou: W80-009

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Lakes-Group 2H

ation, an algebraic relationship was presented giving the value of pressure head midway between lines for surface sources under steady conditions, with or without plant uptake. This form allowed straightforward determination of pressure head using a calculator. As a further aid, nomographs relate pressure head midway between sources to rooting depth, source strength, and uptake amount. The nomographs can be used directly without following through the theoretical developments. Distribution patterns of h for surface and subsurface sources were also given. (Sims-ISWS) W80-00980

### 2H. Lakes

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GAZETTEER OF COAL-MINE LAKES IN SOUTHWESTERN INDIANA, Geological Survey, Indianapolis, IN. Water Re-

sources Div.

L. L. Bobo. Ceological Survey Water-Resources Investigations 79-67 (open-file report), June 1979. 107 p, 54 Fig. 2 Tab, 13 Ref.

Descriptors: \*Lakes, \*Strip mines, \*Coal mines, \*Artificial lakes, \*Indiana, Water quality, Hydrogen ion concentration, Specific conductivity, Color, Lake morphometry, \*Gazetteer of coalmine lakes, \*Southwest Indiana.

mine takes, "Southwest Indiana.

This gazetteer is a catalog of lakes formed by surface coal mining in southwestern Indiana that are 0.5 acre or larger and in nonactive mine areas. Approximately 1,000 of the lakes are listed by 7.5-minute quadrangle topographic-map name, lake-identification number, latitude and longitude, and county. Other data given are shape of lake, maximum length, mean width, length and development of shoreline, surface area, orientation, presence of a stream inlet or outlet, and geologic data (geologic formation of area surrounding the lake and the mined coal-bed member). Field data (sampling date, pH, specific conductance, apparent color of lake, and general vegetation along the shoreline) were collected for 287 of the lakes. The apparent colors of the lakes observed were varying shades of aqua, blue, brown, lime green, red, and green. (Woodard - USGS)

W80-00921

ANALYSIS OF WATER-LEVEL FLUCTU-ATIONS OF LAKES WINONA AND WINNER-MISSETT-TWO LANDLOCKED LAKES IN A KARST TERRANE IN VOLUSIA COUNTY, FLORIDA, Geological Survey, Tallahassee, FL. Water Re-

sources Div.

sources Div.

G. H. Hughes.

Available from the National Technical Information
Service, Springfield, VA 22161 as PB-299 860,
Price codes: AQ2 in paper copy, AQ1 in microfiche.
Geological Survey Water-Resources Investigations
79-55, 1979. 24 p, 16 Fig, 5 Ref.

Descriptors: \*Lakes, \*Water level fluctuations, \*Rainfall disposition,\*Surface-groundwater relationships, \*Karst hydrology, Artesian aquifers, Water table aquifers, Lake basins, Storm runoff, Inflow, \*Lake Winona(FL), \*Lake Winnemissett(FL), \*Volusia County(FL).

The water levels of Lakes Winona and Winnemissett in Volusia County, Fla., correlate reasonably well during dry spells but only poorly during wet spells. Disparities develop mostly at times when the lake levels rise abruptly owing to rainstorms passing over the lake basins. The lack of correlation is attributed to the uneven distribution of the storm rainfall, even though the average annual rainfall at National Weather Service gages in the general area of the lakes is about the same. Analyses of the monthly rainfall data show that the rainfall variability between gages is sufficient to account for most of the disparity between monthly changes in the levels of the two lakes. The total annual rainfall at times may differ between rainfall gages by as much as 15 to 20 inches. Such differences tend to balance over the long term but may The water levels of Lakes Winona and Winnemis-

persist in the same direction for two or more years, causing apparent anomalies in lake-level fluctuations. (Woodard-USGS) W80-00925

CONVECTIVE AND ADVECTIVE CIRCULA-TION OF LAKE POWELL, UTAH-ARIZONA, DURING 1972-1975, Dartmouth Coll., Hanover, NH. Dept. of Earth

Sciences.

N. M. Johnson, and D. H. Merritt.

Water Resources Research, Vol 15, No 4, p 873-884, August 1979. 13 Fig, 14 Ref, 1 Append.

Descriptors: "Water circulation, "Utah, "Arizona, "Colorado river, Hydrology, Lakes, Convection, Advection, Dissolved solids, Lake morphology, Water chemistry, Water temperature, "Lake circulation, "Lake Powell(AZ), "Glen Canyon Dam(AZ), Convective circulation, Advective circulation, Lake stratification, Total dissolved solids.

The water circulation in Lake Powell has been documented and analyzed for the period 1972-1975 on a monthly, synoptic basis. From its inception, Lake Powell has convectively mixed only during the winter cooling period. However, at no time during 1972-1975 did this vertical mixing extend to the lake bottom. During the winter, dissolved salt becomes important in stabilizing the lake. The yearly heat budget of the lake averages 40kcal/sq cm. A dominant feature of the summer circulation of the lake is an overflow density current from the upstream Colorado River. The overflow current mechanically sets the depth and extent of the thermocline. During maximum stratification (July-Septonocline) The water circulation in Lake Powell has been mechanically sets the depth and extent of the thermocline. During maximum stratification (July-September), a pervasive and intense oxygen-depletion layer develops immediately below the epilimnion-thermocline interface. Cold, dense upstream waters intrude the lake during the winter as an underflow density current, which annually replenishes the oxygen supply of the bottom waters. An integral component of the lake's circulation throughout theyear is a withdrawal current at mid-depth within the lake. The configuration and extent of the withdrawal current are a function of dam operation and seasonal density stratification. (Lee-ISWS)

THE LIMNOLOGICAL RESPONSE OF A WEST VIRGINIA MULTIPURPOSE IM-POUNDMENT TO ACID INFLOWS, Army Engineer District, Pittsburgh, PA. For primary bibliographic entry see Field 5B. W80-00954

MEASUREMENTS IN INTERSECTING SUB-MERGED AND INDUCED JETS, Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
W. H. C. Maxwell, and A. Snorrason.
Report UILU-ENG-79-2011, 1979. 37 p, 7 Fig, 1
Tab, 17 Ref.

Descriptors: \*Jets, \*Laboratory tests, \*Model stud-ies, \*Flow, Hydraulics, Measurement, Laboratory equipment, Velocity, Analysis, Analytical tech-niques, Mathematical models, Hydraulic models, Mixing, Submerged jets, Water jets, Air jets.

Simple analytic models were developed using the momentum principle to predict the axis of the resultant flow when (1) two jets of the same fluid cross, and (2) a horizontal water jet is crossed by a vertical jet induced by an air bubble source. Data were collected for two crossing air jets and two crossing water jets. This, together with data from another source, gave excellent agreement with the analytic model. Data over a limited range of relative water discharges were collected for the water bubble screen flow and showed good agreement with the analysis in that range. The range of relative discharges of air and water needs to be extended. It would also be of interest to conduct experiments in which the relative locations of the air source and water jet are varied. There is a need for further work to determine how to predict the combined flow field in its entirety rather than to focus only on the axis of maximum velocity and to extend the results to practical applications such as

cooling water discharges into cross-currents in streams or reservoirs. (Humphreys-ISWS) W80-00977

SEDIMENT OXYGEN DEMAND IN A SHAL-LOW OXBOW LAKE, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 5A. W80-01010

MICROBIAL TRANSFORMATIONS OF SULFUR COMPOUNDS IN A STRATIFIED LAKE (SOLAR LAKE, SINAI), Aarhus Univ. (Denmark). Inst. of Ecology and

Generics.

B. B. Jorgensen, J. G. Kuenen, and Y. Cohen.

Limnology and Oceanography, Vol 24, No 5, p
799-822, September 1979. 13 Fig. 5 Tab, 48 Ref.

Descriptors: \*Lakes, \*Sulfur compounds, \*Aquatic microbiology, Stratification, Chemicals, Temperature, Water temperature, Oxygen, Carbon dioxide, Hydrogen sulfide, Sulfates, Sulfides, Saliny, Chemical stratification, Bacteria, Microbiology, Sampling, Chemical analysis, Limnology, \*Solar lake(Sinai).

Microbiological and chemical aspects of the sulfur cycle were studied in the chemocline of a tropical salt lake. Oxygen and sulfide coexisted in a 0-10-cm cycle were studied in the chemocline of a tropical salt lake. Oxygen and sulfide coexisted in a 0-10-cm layer which migrated up and down during a diurnal cycle. Sulfide was rapidly oxidized by oxygen, with a half-life of 5-10 min, to produce mainly sulfate and thiosulfate. Thiosulfate and elemental sulfur had concentration maxima in the chemocline, while polysulfide was abundant throughout the sulfide zone. Radiotracer experiments showed that the elemental sulfur was produced by anoxygenic photosynthesis in cyanobacteria. The elemental sulfur was further oxidized or again reduced, depending on the presence or absence of oxygen. Cyanobacteria in the chemocline shifted between anoxygenic photosynthesis in the morning and oxygenic photosynthesis in the morning and in the chemocline which could be stimulated by sulfide, elemental sulfur, and thiosulfate. The oxidation rate of sulfide in the chemocline was dependent on the presence of bacteria. (Sims-ISWS)

AN IMPROVED AERODYNAMIC EVAPORA-TION TECHNIQUE FOR LARGE LAKES WITH APPLICATION TO THE INTERNATIONAL FIELD YEAR FOR THE GREAT LAKES, National Oceanic and Atmospheric Administra-tion, Ann Arbor, MI. Great Lakes Environmental Research Level (1997).

For primary bibliographic entry see Field 2D. W80-01029

TRANSVERSE UPWELLING IN A LONG NARROW LAKE, WITH APPLICATIONS TO BABINE LAKE AND LAKE MICHIGAN, College of New Caledonia, Prince George (British College of St. Columbia).
C. A. Lee, and L. A. Mysak.
Atmosphere-Ocean, Vol 17, No 3, p 200-218, 1979.
12 Fig. 1 Tab, 19 Ref, 1 Append.

Descriptors: \*Upwelling, \*Lakes, \*Winds, \*Lake Michigan, \*Model studies, Mathematical models, Theoretical analysis, Thermocline, Circulation, Water circulation, Stress, Wind pressure, Limno-logy, \*Babine Lake(British Columbia), Narrow

The wind generation of transverse thermocline motions in an infinitely long two-layer channel was studied theoretically. Winds both along and across the channel were considered. Horizontal momentum transfer was parameterized by a constant coefficient of eddy viscosity. For a channel narrow compared with its internal Rossby radius of deformation, the transverse motions are uni-modal and are generated most efficiently by long-shore winds. Theoretical results in this narrow channel limit agreed well with observations made at Babine Lake, British Columbia. For a channel wide com-

### Field 2-WATER CYCLE

### Group 2H-Lakes

pared with its Rossby radius, the response is multimodal, especially for cross-channel winds. For a
model Lake Michigan, computed interfacial displacements due to a steady wind either across or
along the channel are small compared with the
observed displacements. However, a semi-diurnal
wind (in either direction) is in near resonance with
the seventh transverse mode. Thus, multi-modal
displacements as large as those observed could
possibly be generated by semi-diurnal winds across
or along the channel. (Sims-ISWS)
W80-01030

SURVEY OF SOME CANADIAN LAKES FOR THE PRESENCE OF ULTRASTRUCTURALLY DISCRETE PARTICLES IN THE COLLOIDAL

National Water Research Inst., Burlington (Ontar-

For primary bibliographic entry see Field 5A. W80-01037

THE DEAD SEA: DEEPENING OF THE MIXO-LIMNION SIGNIFIES THE OVERTURE TO OVERTURN OF THE WATER COLUMN. Weizmann Inst. of Science, Rehovot (Israel).

I. Steinhorn, G. Assaf, J. R. Gat, A. Nishry, and

A. Nissenbaum. Science, Vol 206, No 4414, p 55-57, October 5,

1979. 2 Fig, 8 Ref.

Descriptors: \*Lakes, \*Saline lakes, \*Salinity, Mixolimnion, Meromixis, Turnovers, Stratification, Salts, Saline water, Temperature, Water temperature, Chemicals, Manganese, Iron, Helium, Surveya, On-site investigations, Limnology, \*Dead veys, On-s Sea(Israel).

Throttling of freshwater inputs into the meromictic Dead Sea weakened the longterm stability of the water column. Between 1975 and 1978, successive deepenings of the pycnocline from 70 meters to beyond 200 meters were recorded. Complete over-turn finally took place during the winter of 1978-1979. This unique process was accompanied by changes in the geochemistry of several components. (Sims-ISWS)

### 2J. Erosion and Sedimentation

EFFECT ON SEDIMENT YIELD AND WATER QUALITY OF A NONREHABILITATED SURFACE MINE IN NORTH-CENTRAL WYO-

Geological Survey, Cheyenne, WY. Water Resources Div., and Geological Survey, Lakewood,

CO. Water Resources Div. B. H. Ringen, L. M. Shown, R. F. Hadley, and T. K. Hinkle

K. Hinkley.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 868, Price codes: A02 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-47, 1979. 23 p, 9 Fig, 7 Tab, 5 Ref.

Descriptors: "Coal mines, "Strip mine wastes, "Sediment yield, "Water quality, "Wyoming, Erosion, Water pollution, Surface waters, Groundwaters, Topography, Vegetation, Sediment distribution, Sedimentation rates, Ponds, "North-central Wyoming, "Unrehabilitated strip-mining area.

Sediment and chemical quality of water data were collected from two adjacent drainage basins in northern Wyoming to compare hydrologic differences between an undisturbed basin. Rate of sediment accumulation in a pond in the basin that was surface mined for coal and left unrehabilitated was over 11 times greater than in a pond in the adjacent unmined basin. The additional sediment came primarily from barren high walls and roughly graded spoils. No sediment was yielded from ungraded spoil rows that drained to closed depressions. Most sediment yielded from the two basins was trapped in the two ponds. The chemical comwas trapped in the two ponds. The chemical com-position of materials from slopes, channels, and pond bottoms of the two basins were similar; how-

ever, concentrations of dissolved and suspended matter in waters of the two ponds were different. Low concentrations of dissolved chemical constituents in the pond water below the unmined basin suggest surface runoff as the source. Higher basin suggest surface runoff as the source. Higher concentrations of disordord chemical constituents, notably calcium, magnesium, and sulfate, in pond water below the mined area suggest ground-water discharge as the source. Sediment yield was a better indicator of the effects of disturbance on mined areas than chemical quality of water. (Wooderd USCs) W80-00928

CHEMICAL AND PHYSICAL PROCESSES CONTROLLING THE CHEMICAL COMPOSITION OF SUSPENDED MATERIAL IN THE RIVER TAY ESTUARY, Edinburgh Univ. (Scotland). Grant Inst., of Geolo-

gy. For primary bibliographic entry see Field 2L. W80-00960

SUSPENDED SEDIMENT SOURCES IDENTI-FIED BY MAGNETIC MEASUREMENTS, Exeter Univ. (England). Dept. of Geography. D. E. Walling, M. R. Peart, F. Oldfield, and R.

Thompson. Nature, Vol 281, No 5727, p 110-113, September 13, 1979. 4 Fig, 1 Tab, 11 Ref.

Descriptors: \*Sediments, \*Suspended solids, \*Sediment transport, \*Laboratory tests, Sampling, Magnetic studies, Runoff, Erosion, Soil erosion, Water pollution, Water pollution sources, Pollutant identification, Sedimentology, Magnetic measurements, Suspended sediment sources.

A procedure for identifying the main source of the suspended sediment load of a stream by simple, cheap, rapid, and nondestructive magnetic measurements is applicable to samples taken during the routine sampling of flood events, permitting general characterization of the load and more detailed investigation of variations in sediment source both during and between individual flood events. (Sims-ISWS) W80-00964

PRELIMINARY IDENTIFICATION OF PRICE RIVER BASIN SALT PICK-UP AND TRANSPORT PROCESSES,

Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.

J. P. Riley, D. S. Bowles, D. G. Chadwick, and W.

Water Resources Bulletin, Vol 15, No 4, p 984-995, August 1979. 4 Fig, 21 Ref.

Descriptors: \*Rivers, \*Colorado River, \*Salinity, \*Sediment transport, \*Utah, Model studies, Mathematical models, Watersheds(Basins), Salts, Sediments, Erosion, Channel erosion, Flow, Streamflow, Hydrology, \*Price River(UT).

The Price River is a significant contributor of salt to the Colorado River. Relatively pristine waters leaving the upper elevations of the basin degenerate into highly saline waters entering the Green River. This paper presented the structure of an evolving model of the salt pick-up and transport processes in the Price River basin. The initial purpose of the model was to aid in the identification of the natural and man-modified hydro-salinity-sediment system of the basin, based on data collection and analysis in the field and the laboratory. This identification procedure will result in both a better qualitative understanding of the important physiochemical processes and a mathematical description of these processes. When the identification stage is complete, the model will be used as a management tool for such purposes as examining various stratetool for such purposes as examining various strategies for reducing salt loads in the Price River and in other similar rivers. (Sims-ISWS) W80-00981

SEDIMENTATION AND THE DISTRIBUTION OF ORGANIC MATTER IN A SUB-ANTARC-TIC MARINE BAY,

British Museum of Natural History, London. H. M. Platt. Estuarine and Coastal Marine Science, Vol 9, No 1, p 51-63, July 1979. 6 Fig. 4 Tab, 28 Ref.

Descriptors: \*Sedimentation, \*Organic matter, \*Bays, \*Antarctic, \*Antarctic Ocean, Sediments, Cores, Sampling, Coasts, Salinity, Water temperature, Winds, Runoff, Rainfall, Sediment transport, Spatial distribution, Estuaries, Sediment traps.

The annual rate of sediment accumulation and the proportion due to resuspension in a sheltered sub-Antarctic bay were deduced from sediment trap experiments and vertical profiles of organic matter in the sea bed. A dry weight sediment accumulation of 2800 G/sq m/year was suggested with an organic input of 60 g carbon/sq m/year. Seasonal variations in sedimentation were associated with winds and land runoff. Residual organic matter in deep sediment profiles reflects the recent history of pollution in the area and provides a means of dating the sediments. (Sims-ISWS)

A MODEL FOR THE ESTIMATION OF THE CONCENTRATIONS AND SPATIAL EXTENT OF SUSPENDED SEDIMENT PLUMES,

State Univ. of New York, Stony Brook. Marine Sciences Research Center.
R. E. Wilson. Estuarine and Coastal Marine Science, Vol 9, No 1, p 65-78, July 1979. 8 Fig. 5 Ref.

Descriptors: \*Sediments, \*Suspended solids, \*Spatial distribution, \*Dredging, \*Gulf of Mexico, Diffusion, Model studies, Mathematical models, Oceans, Coasts, Settling velocity, On-site data collections, Spoil banks, Sedimentation, lections, Spoil banks, Sediment Plumes(Aquatic), Diffusion-advection models

A simple model was presented for the spatial structure of suspended sediment plumes produced by overboard pipeline disposal of dredge spoil in shal-low waters. The model was based on a solution to the advection-diffusion equation for a continuous vertical line source. It provided information on the variation of both centerline concentration and the variation of both centerline concentration and the second moment of the lateral distribution with distance from the source. The structure of the plume was described by only two parameters: one proportional to the settling velocity of the suspended material, and the other equal to the ratio of a diffusion velocity to the advective velocity of the ambient flow. The model was applied to represent the structure of observed suspended sediment plumes at three separate shallow water sites. (Sims-ISWS) W80-01016

ESTIMATING AVERAGE VELOCITY IN GRAVEL-BED RIVERS,
New Brunswick Univ., Fredericton. Dept. of Civil

Engineering.
For primary bibliographic entry see Field 2E.
W80-01023

SEDIMENTATION PROCESSES IN A SHORT RESIDENCE-TIME INTERMONTANE LAKE, KAMLOOPS LAKE, BRITISH COLUMBIA, National Water Research Inst., Vancouver (British Columbia).

Columbia). C. H. Pharo, and E. C. Carmack. Sedimentology, Vol 26, No 4, p 523-541, August 1979. 13 Fig, 1 Tab, 27 Ref.

Descriptors: \*Sedimentation, \*Lakes, \*Canada, \*Deltas, On-site investigations, Rivers, Analysis, Analytical techniques, Sedimentation rates, Suspended load, Sediment transport, Sediments, Onsite data collections, Turbidity, Description, Sediments, Turbidity, Currents, Description, Sediments, Turbidity, Currents, Description, Sediments, Turbidity, Currents, Description, Sediments, Onsite data Collections, Turbidity, Currents, Description, Sediments, Canada, Page 1981, 2011, 20 pended load, Sediment transport, Sediments, On-site data collections, Turbidity, Deposition(Sediments), Turbidity currents, Densi-ty currents, Geomorphology, Water temperature, 'British Columbia, 'Kamloops Lake(British Co-lumbia), \*Thompson River(British Columbia).

Kamloops Lake in central British Columbia is a deep, intermontane lake fed by the strong and seasonally variable flows of the Thompson River. Briefly, the lake is typical of fjord-type intermon(maximu the do m/s; an lake lev bulk res less the ations o transpo esses: ence v ding; s delta lakewi by the Coriol rate a the rig

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tane lakes; it is long (25 km), narrow (2.1 km), deep (maximum depth, 145 m), and situated in a relict glacial valley. The flow of the Thompson River, the dominant river entering Kamloops Lake, shows high seasonal variability (range, 100-3000 cu m/s); annual mean, 700 cu m/s). As a consequence, lake level varies annually by up to 7 m, while the bulk residence time for lake water (defined as T = V/R, where V is lake volume and R is streamflow) varies from approximately 1 year in late winter to less than 20 days during spring freshet. Considerations of lake-river interaction, supported by physical and geological evidence, suggest that sediment transport and deposition within the lake is controlled by three interdependent but distinct processes: delta progradation at the lake-river confluence which results in delta topset and foreset bedding; sediment density surges originating along the delta face which result in turbidite sequences lakeward from the base of the delta; and dispersal by the interflowing river plume which, due to Coriolis effects, results in a higher sedimentation rate and greater fraction of coarser material along the right-hand side (Northern Hemisphere) of the lake in the direction of flow. (Humphreys-ISWS) W80-01034

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UNDULAR HYDRAULIC JUMPS AND THE FORMATION OF BACKLASH RIPPLES ON BEACHES,

Oregon State Univ., Corvallis. School of Oceanography.

For primary bibliographic entry see Field 2L. W80-01035

PROCEEDINGS OF A WORKSHOP ON COASTAL ZONE RESEARCH IN MASSACHU-SETTS (NOVEMBER 27-28, 1978), Woods Hole Oceanographic Institution, MA.

Woods Hole Oceanographic Institution, MA:

Woods Hole Oceanographic Institution Technical
Report WHOI-79-40, April 1979. 118 p, 3 Append.

Descriptors: \*Coasts, \*Estuaries, \*Beaches, \*Oceanography, Geology, Sediment transport, Sedimentation, Massachusetts, Coastal zone, Beach profiles, Sea Grant program.

A Workshop on Coastal Zone Research held on 27 and 28 November, 1978, at Woods Hole Oceanographic Institution, brought together fifty researchers actively studying physical processes in the Massachusetts coastal zone. Although the scope of the workshop was narrow, emphasizing only selected aspects of coastal zone research, it represented an important attempt to assess knowledge of physical processes in the nearshore, and to encourage cooperation and communication between scientists. Two sets of recommendations evolved from the workshop. The first set recommends ways to facilitate scientist - user communication, and provide more rapid dissemination of coastal research results. The second set describes areas of future research in the Massachusetts coastal zone. (NOAA) W80-01136

EFFECTS OF AN OIL SPILL ON SALT MARSHES AT HARBOR ISLAND, TEXAS. I: BIOLOGY.

S. Holt, S. Rabalais, N. Rabalais, S. Cornelius, and J. S. Holland.

J. S. Holland. In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 345-352, 1 Fig, 2 Tab, 7 Ref.

Descriptors: \*Oil spills, \*Salt marshes, \*Environmental effects, \*Water pollution effects, Surveys, Resources development, Texas, Pipelines, \*Outer continental shelf, Spartine alterniflora, Avicennia germinans, Monitoring.

On October 13, 1976, an American Petrofina Company pipeline ruptured, dumping about 377 barrels of crude oil into the cordgrass (Spartina alterniflora and black mangrove (Avicennia germinans) marshes at Harbor Island in Redfish Bay near Port Aransas, Texas. A biological and chemical survey

was begun the day following the spill. A single study afte (4 stations ranging from above mean high tide to below mean low tide) was selected to monitor the benthos. Surveys of marsh vegetation were made on periodic trips to the area. Various types of clean-up procedures (Including no cleanup of some areas) and different concentrations of oil coverage were monitored. (Sinha - OEIS) W80-01149

BIOLOGICAL MONITORING OF SEDIMENTS IN EKOFISK OILFIELD, Field Studies Council, Pembroke (England). Oil Pollution Research Unit. For primary bibliographic entry see Field 5C. W80-01156

THE INFAUNAL BENTHOS OF PETROLEUM-CONTAMINATED SEDIMENTS: STUDY OF A COMMUNITY AT A NATURAL OIL SEEP, California Univ., Livermore. Lawrence Livermore Lab. For primary bibliographic entry see Field 5C. W80-01158

POTENTIAL LONG-TERM EFFECTS OF PRUDHOE BAY CRUDE OIL IN ARCTIC SEDIMENTS ON INDIGENOUS BENTHIC IN-VERTEBRATE COMMUNITIES, Louisville Univ., KY. Dept. of Biology. For primary bibliographic entry see Field 5C. W80-01160

### 2K. Chemical Processes

GEOHYDROLOGY OF BROOKS, LOWNDES, AND WESTERN ECHOLS COUNTIES, GEOR-GIA.

Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W80-00941

ATMOSPHERIC CONTRIBUTIONS TO STREAM WATER CHEMISTRY IN THE NORTH CASCADE RANGE, WASHINGTON, Washington Univ., Seattle. Dept. of Geological Sciences.

Water Resources Research, Vol 15, No 4, p 787-794, August 1979, 4 Fig. 9 Tab. 52 Ref.

Descriptors: \*Chemistry of precipitation, \*Water pollution sources, \*Precipitation(Atmospheric), \*Washington, Streams, Lakes, Surface waters, Runoff, Mountains, Water pollution, Pollutants, Path of pollutants, Chemicals, Sampling, Data processing, Chemistry, \*Cascade range(WA).

processing, Chemistry, \*Cascade range(WA).

Bulk precipitation contributes significant quantities of cations and trace metals to a subalpine catchment located in the North Cascade Range of Washington. Precipitation loadings account for 30% of the major and more than 50% of the minor element export from the catchment. Preliminary data from larger basins in the North Cascades suggested similar values. Calcium and potassium measured in bulk precipitation are largely derived from continental dusts, while sodium and magnesium originate as marine aerosols. Lead, copper, and arsenic, products of anthropogenic activity in the Puget Lowland, are deposited downwind in the Cascade Mountains; mean precipitation pH at the study site was 4.85 during 1974 and 1975. Elements contributed by precipitation become part of complex upland biogeochemical cycles. With the exception of highly mobile ions like sodium, elemental levels in streamflow reflect biologic and pedogenic cycling processes rather than direct precipitation influence. (Sims-ISWS)

MICROBIAL TRANSFORMATIONS OF SULFUR COMPOUNDS IN A STRATIFIED LAKE (SOLAR LAKE, SINAD, Aarhus Univ. (Denmark). Inst. of Ecology and

Genetics. For primary bibliographic entry see Field 2H. W80-01024

NIAGARA RIVER CHEMICAL LOADING 1975-

1977, Canada Centre for Inland Water, Burlington (Ontario).

C. H. Chan. Scientific Series No 106, 1979. 11 p, 19 Fig, 8 Tab, 9 Ref.

Descriptors: \*Water sampling, \*Chemical analysis, \*Data collections, Hydrogen ion concentration, Phosphorus, Nitrogen, Sodium, Calcium, Lake Erie, Sampling, Average flow, \*Niagara River, Niagara-on-the-Lake, Chemical loading.

Niagara-on-the-Lake, Chemical loading.

Detailed analyses of chemical data collected daily over a 29-month period from August 1975 to December 1977 at Niagara-on-the-Lake have identified short-term trends in some of the water quality parameters. The pH, phosphorus and nitrogen concentrations remained relatively stable. Seasonal variation in major ions concentrations was observed to occur inversely to the outflow of the Niagara River. Due to a 9 percent decline in water supply to Lake Erie during 1977, there was a significant decrease in calcium, magnesium and sulphate concentrations, but sodium and chloride concentrations were higher. The annual phosphorus load for 1977 was 1.78 metric tons per day compared with 13.53 metric tons per day in 1976, a 13 percent decrease. Results computed from different sampling frequencies suggested that a sampling frequency of once per week for phosphorus would yield results to within 5 percent of daily sampling. (WATDOC) W80-01172

### 2L. Estuaries

APPLICATION OF TRANSIENT-FLOW MODEL TO THE SACRAMENTO RIVER AT SACRAMENTO, CALIFORNIA, Geological Survey, Menlo Park, CA. Water Resources Div. R. N. Oltmann.

R. N. Oltmann.
Available from the National Technical Information
Service, Springfield, VA 22161 as PB-301 103,
Price codes: A03 in paper copy, A01 in microfiche.
Geological Survey Water-Resources Investigations
78-119, February 1979. 23 p, 6 Fig, 2 Tab, 4 Ref.

Descriptors: \*Unsteady flow, \*Tidal streams, \*Model studies, \*Streamflow, \*Tidal effects, Computer models, Simulation analysis, Methodology, Open channel flow, Flow rates, Stream gages, \*Sacramento River(CA), \*Sacramento-Freeport tidal reach.

The transient-flow simulation model was applied to the Sacramento River at Sacramento, Calif. An alternative is needed to the empirical stage-fall-discharge computational method, which provides only daily mean discharges and requires frequent measurement over a 25-to 26-hour period of the tide-affected flow. Measurement of tide-affected flow involves use of a cable suspended across the river; this presents a hazardous navigational condition. Use of the model does not eliminate the hazardous navigational problem, but it significantly reduces the time that this condition exists. The model has demonstrated that it can provide reliable daily mean as well as instantaneous discharge data. The model also has the capability of providing discharge data for locations farther downstream in the tidal zone from the Sacramento stream gage; this is not possible with the stage-fall-discharge computational method. (Woodard-USGS)

CHEMICAL AND PHYSICAL PROCESSES CONTROLLING THE CHEMICAL COMPOSITION OF SUSPENDED MATERIAL IN THE RIVER TAY ESTUARY, Edinburgh Univ. (Scotland). Grant Inst., of Geolo-

gy. E. R. Sholkovitz.

### Field 2-WATER CYCLE

### **Group 2L—Estuaries**

Estuarine and Coastal Marine Science, Vol 8, No 6, p 523-545, June 1979. 15 Fig. 4 Tab, 48 Ref.

Descriptors: \*Suspended solids, \*Sediments, \*Chemicals, \*Estuaries, On-site investigations, Laboratory tests, Sampling, Rivers, Coasts, Sality, Tides, Mixing, Chemical analysis, Sedimentology, Hydrology, \*British coast, \*River Tay logy, Hydrology, Estuary(England).

The chemical composition (Al, Si, Ti, K, Ca, Mg, P, Org.C, Fe and Mn) of suspended material in the Tay Estuary and River Tay was measured to determine the relation between river and estuary material and chemical reactions which may be material and chemical reactions which may be occurring during estuarine mixing. Variations in the ratios of Fe/Al, Mn/Al, Ti/Al, etc., with salinity and suspended load during a tidal station suggest that sedimentological and hydrological processes, rather than chemical ones, are responsible for the observed compositional changes. This interpretation was confirmed by laboratory mixing experiments which also contradicted published reports of Fe and Mn desorption in estuaries. Measurements of suspended matter composition will not easily determine whether desorption or adsorption of element occurs when river-borne suspended material enters the saline environment. A tentative conclusion on the River Tay study was that the suspended matter in the Tay Estuary results from the input of material at times of high suspended loads and of high river water discharge. (Sims-ISWS) W80-00960

VARIATIONS OF LONGITUDINAL DIFFUSI-VITY IN THE HUDSON ESTUARY, City Coll. of New York. Inst. of Marine and At-mospheric Sciences.

Business Sciences.

E. S. Posmentier, and J. M. Raymont.

Estuarine and Coastal Marine Science, Vol 8, No 6, p 555-564, June 1979. 4 Fig, 2 Tab, 9 Ref.

Descriptors: \*Estuaries, \*Diffusivity, \*Salinity, \*Hudson River, Model studies, Mathematical models, On-site investigations, Tidal waters, Tides, Data collections, Data processing, Salts, Saline water-freshwater interfaces, Mixing, Coasts, Circulation, Water circulation, \*Hudson Estuary(NY).

The coefficient of longitudinal diffusion for salt was calculated from the distribution of salinity observed in the Hudson Estuary at 9 different times during 1974. The salinity distribution appears to be quasi steady-state, and the diffusion coeffito be quasi steady-state, and the diffusion coeffi-cient is spatially constant between the Upper Bay and Verplanck. The diffusion coefficient varied in time by a factor of 3. It was not well correlated with the stratification parameter. It was slightly less dependent on the freshwater discharge in the less dependent on the freshwater discharge in the Estuary than on the tidal amplitude, which varies by a factor of nearly 2 between spring and neap tides. Salinities predicted by a model are slightly less accurate if the diffusion coefficient depends on the stratification parameter than if the diffusion coefficient is kept constant. If the diffusion coeffi-cient is coefficient of both for the process. cient is a power function of both freshwater dis-charge and tidal amplitude, salinity predictions are significantly improved. These results suggest that density-induced, gravitational, vertical circulation does not dominate the longitudinal diffusion of salt in the Hudson Estuary. Transverse circulation may be at least as significant a salt transport mechanism as vertical circulation. The predictive reliability of a one-dimensional, advective-diffusive model of the salinity distribution in the Hudson Estuary depends on a realistic, variable coefficient of longi-tudinal diffusion for salt. Furthermore, such a model cannot use the same coefficient to predict the distribution of other properties unless the com-bination of transport mechanism for these other properties is the same as that for salt. (Sims-ISWS) W80-00961

MESUNANT OVER-TIDE ACROSS AND ALONG TASMAN BAY, NEW ZEALAND, Department of Scientific and Industrial Research, Wellington (New Zealand) Wellington (New Zealand). Oceanographic Inst. R. A. Heath.

Estuarine and Coastal Marine Science, Vol 8, No 6, p 583-595, June 1979. 8 Fig, 2 Tab, 16 Ref.

Descriptors: \*Tides, \*Bays, \*Water circulation, Circulation, Currents(Water), Mathematical models, Model studies, Water levels, Wavelengths, Waves(Water), Ocean waves, Oceanography, \*New Zealand, \*Tasman Bay(New Zealand).

East-west current oscillations in Tasman Bay with a quarter (6.2 h), sixth (4.1 h) and eighth (3 h) diurnal periodicity were shown to be generated by non-linear field acceleration of the semi-diurnal tidal water motion near D'Urville Island resulting from rapid change of the tidal amplitude with distance. These over-tides force oscillations directed access (waster and eighth-diurnal) and actional control of the control of ustance. I nese over-tides force oscillations directed across (quarter and eighth-diurnal) and along (sixth-diurnal) Tasman Bay in which respective directions the quarter wavelength oscillation wave resonant periods are near the quarter and sixth diurnal period. (Sims-ISWS) W80-00962

WIND-WAVE RELATIONSHIPS FOR A COASTAL SITE IN THE CENTRAL ENGLISH

Southampton Univ. (England). Dept. of Civil En-

gineering. G. Henderson, and N. B. Webber. Estuarine and Coastal Marine Science, Vol 9, No 1, p 29-39, July 1979. 6 Fig. 4 Tab. 11 Ref.

Descriptors: \*Waves(Water), \*Coasts, \*On-site in-Descriptors: "Waves(Water), "Coasts, "On-site in-vestigations, "Forecasting, Analysical techniques, On-site data collections, Wind veloc-ity, Foreign research, Mathematical models, Cor-relation analysis, Winds, "England, "English chan-nel, Wave height, Wind-wave relationships.

Waves have been recorded at a coastal site in the Vaves have been recorded at a cossats at an in the Central English Channel over a period of two years. By correlating wind and wave height data empirical relationships were derived which were extrapolated to take account of the significantly longer period of wind data. By this means, both the long-term wave climate and the wave heights me iong-term wave climate and the wave heights associated with storm conditions may be predicted for the more exposed wind sector. The method is relatively straightforward and capable of general application. (Humphreys-ISWS) W80-01012

SEASONAL GEOSTROPHIC VOLUME TRANSPORTS ALONG THE SCOTIAN SHELF, Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab. K. Drinkwater, B. Petrie, and W. H. Sutcliffe, Jr. Estuarine and Coastal Marine Science, Vol 9, No 1, p 17-27, July 1979. 7 Fig, 1 Tab, 21 Ref.

\*Ocean "Currents(Water), "Continental shelf, "Atlantic Ocean, Coasts, Circulation, Seasonal, Variability, Sampling, Velocity, Flow, Data processing, Oceanography, "Nova Scotia coast, Geostrophic

Mean monthly geostrophic volume transports were calculated through a transect across the Sco-tian Shelf known as the Halifax Section. The net tian Shelf known as the Halifax Section. The net alongshore volume transport over the shelf has an annual mean of 0.35 sverdrups (sv) to the southwest, being largest in winter (0.60 sv) and smallest in summer (0.15 sv). Flow over the inshore third of the shelf accounts for 75% of the calculated net annual transport. The source of this flow appears to be the Gulf of St Lawrence. (Sims-ISWS) W80-01013

REMOVAL OF 'SOLUBLE' IRON IN THE PO-TOMAC RIVER ESTUARY, Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst. For primary bibliographic entry see Field 5A. W80-01014

SEDIMENTATION AND THE DISTRIBUTION OF ORGANIC MATTER IN A SUB-ANTARC-TIC MARINE BAY, British Museum of Natural History, London. For primary bibliographic entry see Field 2J. W80-01015

A MODEL FOR THE ESTIMATION OF THE CONCENTRATIONS AND SPATIAL EXTENT OF SUSPENDED SEDIMENT PLUMES, State Univ. of New York, Stony Brook. Marine Sciences Research Center.

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For primary bibliographic entry see Field 2J. W80-01016

DISCUSSION OF THE BEHAVIOUR OF NON-CONSERVATIVE DISSOLVED CONSTITU-ENTS IN ESTUARIES,

Dartmouth Coll., Hanover, NH. Dept. of Earth For primary bibliographic entry see Field 5B. W80-01017

FORCED FORTNIGHTLY TIDES IN SHALLOW RIVERS,
British Columbia Univ., Vancouver. Dept. of

Oceanography.
For primary bibliographic entry see Field 2E. W80-01031

UNDULAR HYDRAULIC JUMPS AND THE FORMATION OF BACKLASH RIPPLES ON

Oregon State Univ., Corvallis. School of Oceanog-

R. Broome, and P. D. Komar. Sedimentology, Vol 26, No 4, p 543-559, August 1979. 9 Fig, I Tab, 13 Ref. NOAA 04-7-158-44085.

Descriptors: \*Beaches, \*Sand waves, \*Hydraulic jump, \*Model studies, Wavelengths, Laboratory tests, On-site investigations, Hydraulics, Mathematical models, Ripple marks, Analytical techniques, Measurement, Beach erosion, Sediment transport, Hydraulic models, Undular hydraulic

Field observations were made of the formation of backwash ripples on the beach face, formed by undular hydraulic jumps generated by backwash down the beach face colliding with wave bores. Measured ripple wavelengths range from set averages of 48 to 70 cm. Within a particular set of ripples, the spacing tends to decrease in the offrshore direction. These observations were compared with laboratory experiments where undular jumps were generated in a flume and with a computer simulation model which calculated both the flow within an undular hydraulic jump and the resulting sediment transport which gives rise to the backwash ripples. The computer model involved a numerical solution of the Boussiness equations which govern the fluid flow and sediment transport equations which relate the sand transport rate to the local mean flow velocity. The model permitted a study of the detailed time-history of the undular jump development and the formation of the backwash ripples and showed good agreement with the field observations of backwash ripples, predicting an offshore decrease in their spacings. The laboratory experiments showed a similar result so long as the Froude number of the supercritical flow before the jump occurs is small (F = 1.4). Small differences between the computer model and experiments arose principally from the neglect of internal friction and surface tension in the model. (Humphreys-15WS) (Humphreys-ISWS) W80-01035

NUTRIENT CYCLING AND PRIMARY PRODUCTION IN PORT HACKING, NEW SOUTH

Commonwealth Scientific and Industrial Research Organization, Cronulla (Australia). Div. of Fisheries and Oceanography.
For primary bibliographic entry see Field 5C.
W80-01122

PROCEEDINGS OF A WORKSHOP ON COASTAL ZONE RESEARCH IN MASSACHU-Woods Hole Oceanographic Institution, MA. For primary bibliographic entry see Field 2J. W80-01136

### WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 3

### Conservation In Agriculture—Group 3F

SINKING OF OIL IN LOS ANGELES HARBOR, CALIFORNIA FOLLOWING THE DESTRUC-TION OF THE SANSINENA,

University of Southern California, Los Angeles. Environmental Geology Program. For primary bibliographic entry see Field 5C. W80-01151

ACCUMULATION OF PETROLEUM HYDRO-CARBONS IN A SALT MARSH ECOSYSTEM EXPOSED TO STEADY STATE OIL INPUT, Louisiana State Univ, Baton Rouge. Dept. of Marine Science.

For primary bibliographic entry see Field 5C.

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### 3. WATER SUPPLY AUGMENTATION AND CONSERVATION

### 3A. Saline Water Conversion

METHOD FOR THE DISTILLATION OF SEA

WATER, Hitachi, Ltd., Tokyo (Japan).
T. Narita, S. Yoshihara, Y. Ikenaga, and T. Iijima.
U.S. Patent No 4,152,218, 5 p. 1 Fig. 3 Ref; Official Gazette of the United States Patent Office, Vol 982, No 1, p 205, May 1, 1979.

Descriptors: \*Patents, \*Desalination processes, \*Water purification, \*Separation techniques, Water quality control, Distillation, Flash distillation, Sulfur compounds, Absorption, Equipment, Waste

The apparatus of the invention is used with a source producing waste gases containing sulfur oxides and includes means to directly contact such waste gases with sea water in order to absorb the sulfur oxides contained in the waste gases. A flue supplies waste gases, a conduit supplies the sea water; and a flue releases the treated waste gases. The device for the oxidation of sulfitte which are produced by the absorption of sulfur oxides produces stable sulfates through a catalytic action of the metallic ions in the sea water. By distilling the sea water that had been used for the removal of sulfur oxides, the apparatus is compact in form in sea water that had been used for the removal or sulfur oxides, the apparatus is compact in form in addition to reducing the cost, and does not require the special chemical pretreatments heretofore em-ployed for supplemental sea water and distillation. (Sinha-OEIS)

W80-00875

CONVERSION OF SEA WATER BY REVERSE OSMOSIS.

Desalination Systems Inc., Escondido, CA. (Assignee). D. T. Bray.

U.S. Patent No 4,156,645, 6 p, 1 Tab, 3 Ref; Official Gazette of the United States Patent Office, Vol 982, No 5, p 1691, May 29, 1979.

Descriptors: \*Patents, \*Water treatment, \*Desalination, Water purification, Reverse osmosis, Sea water, Saline water, Membrane processes, Semi-

A multistage process for recovery of fresh water by reverse osmosis from high salt content feed, such as sea water, comprises treating the feed water in an initial stage at relatively low pressure (between about 300 and 550 psi) employing a loose semipermeable membrane, to produce an intermediate product water containing one-fourth to one-half the TDS (total dissolved solids) content of the original feed water. The intermediate product water is treated in a subsequent stage also at a relatively low pressure (between about 300 and 550 psi) employing a tight semipermeable membrane, to produce a fresh product water containing less than 2,000 ppm TDS, and preferably a potable water containing less than 1,000 ppm TDS. (Sinha -OEIS) W80-00908

A STUDY OF THE IN-SITU INDIRECT FREEZ-

ING PROCESS, New Mexico Univ., Albuquerque. Dept. of Chemical and Nuclear Engineering. C. Y. Cheng.

C. Y. Cheng.

Available from the National Technical Information
Service, Springfield, VA 22161 as PB80-110992,
Price codes: A05 in paper copy, A01 in microfiche.
Final report submitted to Office of Water Research
and Technology, July, 1979, 88 p., 53 Fig, 26 Ref, 2
Append. OWRT S-0060 No. 7502 (1).

Descriptors: "Separation techniques, "Desalination processes, "Crystallization, "Water desalting, Water purification, "Desalting apparatus, "Freezing, Waste water treatment, "Crystal growth, "Nucleation, High pressure, Ultrasonics, Phase diagram, Thermodynamics, Supercooling, Heat transfer, Energy, Melting, Sodium chloride, Permeability, Ice, Sea water, Brackish water, Brines, "Institut, Indirect freezing, "Smooth deposit, "Dendritic deposit, In-situ washing, In-situ melting, Pressure-programmed supersaturation, Heat reuse, Two-pressure zone simultaneous freeze-melt operations, In-situ nucleation, Purification, Para-xylene, Styrene, Monomers. Styrene, Monomers.

It has been demonstrated that high degree separations of aqueous and organic mixtures can be accomplished and an energy saving can be realized by the In-situ Indirect freezing process conducted in a small conduit freezer-melter. The process has two versions: the first version, denoted as the dendritic deposit approach, is useful in accomplishing a high degree separation of a concentrated solution and the second version, denoted as the smooth deposit approach, is useful in a high degree purification of a dilute solution. A pressure-induced nucleation approach and a seeded feed approach with ultrasonic nucleation have been introduced to initiate a freezing step uniformly; a president of the process of the second sec proach with ultrasonic nucleation have been introduced to initiate a freezing step uniformly; a pressure-programmed supersaturation approach has been introduced to obtain a close control of delta t and a close control of the morphology of the deposited solid phase. Products containing less than 350 ppm NaCl were obtained from feeds containing 40,000 ppm and 5000 ppm, respectively, by the two approaches.

W80-01006

A STUDY OF THE VACUUM-FREEZING HIGH PRESSURE ICE-MELTING PROCESS, New Mexico Univ., Albuquerque. Dept. of Chemi-

cal and Nuclear Engineering. C. Y. Cheng.

C. Y. Cheng.

Available from the National Technical Information
Service, Springfield, VA 22161 as PB80-111008,
Price codes: A05 in paper copy, A01 in microficher,
Final Report submitted to Office of Water Research and Technology, June 1979, 70 p, 17 Fig. 20
Ref, 4 Append. OWRT S-0060 No 7502 (2). 14-340001-7502.

Descriptors: \*Desalination processes, \*Separation techniques, \*Water desalting, Water treatment, Ice, Water purification, \*Desalting apparatus, \*Freezing, \*Flash distillation, \*Condensation, \*Evaporation, Sea water, Brackish water, Waste water treatment, Vapor pressure, High pressure, Phase diagram, Heat transfer, Ice-Brine systems, Salinity, Latent heat, Energy, Economics, Feasibility, Thermodynamics, Kinetics, \*Vacuum freezing processes, operations, \*Vapor desublimation, \*High pressure ice-melting, \*Ice-vapor interface, Extended surface freezer, Agitated freezer, Ice washing, Non-condensable gas.

An aqueous solution was flash vaporized under a reduced pressure to simultaneously form a low pressure water vapor and ice crystals. The ice formed was first purified in a counter-washer and then melted inside of heat conductive conduits under a high pressure (e.g. 500 atm.) and the low pressure water vapor was desublimed to form desublimate (ice) on the outside of the conduits. The letter heat of desublimities valued was utilized to subilimate (ice) on the outside of the conduits. The latent heat of desublimation released was utilized in supplying the heat needed in the ice-melting operation. The desublimate was removed intermittently by an in-situ dissolution operation utilizing the feed solution and an equivalent amount of ice was formed inside of the conduits. The process uses components that are available commercially and can be reliably operated. The process is highly energy efficient and cost competitive with other desalination processes and conventional evaporation processes. The process is useful in desalination of brackish water and sea water and in concentrating industrial aqueous solutions.

W80-01007

### 3E. Conservation In Industry

PROCESS FOR CONTROLLING POLLUTION AND CONTAMINATION IN THE ELECTRO-DEPOSITION OF PAINT, Nalco Chemical Co., Oak Brook, IL. (Assignee). For primary bibliographic entry see Field 5D. W80-00886

METHOD FOR RECOVERY OF METALS FROM METAL PLATING BATHS AND NEU-TRALIZING TOXIC EFFLUENTS THERE-

Instytut Mechaniki Precyzyjnej, Warsaw (Poland). For primary bibliographic entry see Field 5D. W80-01181 (Assignee).

### 3F. Conservation In Agriculture

AGRICULTURAL IRRIGATION SYSTEM AND COMPONENTS THEREFOR,

U.S. Patent No 4,151,858, 11 p, 13 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 982, No 1, p 88, May 1, 1979.

Descriptors: \*Patents, \*Irrigation systems, \*Application equipment, Irrigation practices, Irrigation efficiency, Lateral conveyance structures, Hydrau-

An agricultural irrigation wheel line has a line translational propulsion unit and also a series of torque assist or torque booster units spaced along the line. All of the units are hydraulically driven by water pressure in the irrigation line itself. The master unit is provided a coupling for the hose to dragged over the field and coupled to a water-pressure source. Each of the units include a hydraulic jack which effects translation and principal line torquing, as the case may be. Controls are provided the units for regulating the stall-out condition of each unit, at which point the jack becomes inoperative to further apply torque to the line or to translate the line, as the case may be, in the event of a predetermined excessive torque resistance. Accordingly, the units speed up, slow down, or stall out, automatically in response to an undesired line condition, i.e. deflection or deviation from the essential rectilinear condition deation from the essential rectilinear condition de-sired. Should the master unit, therefore, advance sired. Should the master unit, therefore, advance 'ahead' of the rest of the line, the torque resistance of loading of such unit will advance to a point where such master unit will automatically slow down and perhaps even stall out to wait for the other part or portions of the line to 'catch up'. The same likewise applies to the booster units coupled to mutually spaced points along the line. (Sinha-GEIS) OEIS) W80-00873

PART-CIRCLE SPRINKLER HEAD WITH IM-PROVED QUICK-RETURN MECHANISM, Nelson Irrigation Corp., Walla Walla, WA. (As-

Signee). L. P. Meyer. U.S. Patent No 4,153,202, 18 p, 10 Fig. 6 Ref; Official Gazette of the United States Patent Office, Vol 982, No 2, p 536, May 8, 1979.

Descriptors: \*Patents, \*Irrigation, \*Sprinkler irrigation, \*Application equipment, Irrigation practices, Irrigation efficiency.

In a part-circle sprinkler head preferably of the pressure compensating quick return type, the reactant structure on the reversing arm is provided with a coanda-effect surface which aids in moving

### Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

### Group 3F—Conservation In Agriculture

the reactant structure into the stream. The mechanism for disengaging the reactant structure of the reversing arm from the stream minimizes reliance upon inertia to effect the disengagement function by utilizing a secondary reactant element. The spring mechanism which stably maintains the respiring mechanism which stably maintains the respring mechanism which standy manusins the re-versing arm in its inoperative position is interrelat-ed with the reversing arm so that the torque ap-plied diminishes as the reversing arm moves toward its operative position within the stream. (Sinha-QEIS) W80-00852

SOIL PENETRATION EMITTER FOR DRIP IRRIGATION SYSTEMS,

G. R. Hartman.
U.S. Patent No 4,153,380, 4 p, 4 Fig, 7 Ref, Official
Gazette of the United States Patent Office, Vol
982, No 2, p 597, May 8, 1979.

Descriptors: \*Patents, \*Irrigation systems, \*Sub-surface irrigation, Application equipment, Irriga-tion practices, Irrigation efficiency, Flow control, Drip irrigation.

An emitter device for a drip type irrigation system is described. The emitter has an elongated body with a tapered portion at its lower end to facilitate easy insertion into the soil. The upper end of the emitter forms a small receiving chamber connectable to an opening. An adjustable valve means is interposed between the chamber and the opening so that the flow of water from a suitable supply source can be regulated. Outlet openings for the emitter are located near or within the tapered portion of the body so that emission is accomplished below ground level. (Sinha-OEIS) W80-00883

ADJUSTABLE SPRINKLER METHOD OF MAKING SAME, HEAD

U.S. Patent No 4,154,404, 5 p, 5 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 982, No 3, p 939, May 15, 1979.

Descriptors: \*Patents, \*Irrigation, \*Sprinkler irrigation, Application equipment, Irrigation efficiengation, Application eq cy, Irrigation practices

A simple, inexpensive sprinkler head may be adjusted to discharge a fluid in a full circular pattern of variable radius or in a variable size segment of the circular pattern. The structure of the sprinkler head includes a short tubular body having an array of apertures through the wall forming a closed elipse, together with a valve means for adjustment of the radius of the circular seaters. elipse, together with a valve means for adjustment of the radius of the circular pattern of fluid discharge and a movable diaphragm for adjustment of the size of the segment of the circular pattern. The method of making such structure, including the fabrication of the tubular body in two parts by casting or molding techniques is disclosed. (Sinha-OEIS) W80-00892

IRRIGATION SYSTEMS CONTROL, Wade (R.M.) and Co., Portland, OR. (Assignee). G. Cornelius, and L. C. Olson. U.S. Patent No 4,155,679, 6 p. 3 Fig. 7 Ref; Official Gazette of the United States Patent Office, Vol 982, No 4, p 1364, May 22, 1979.

Descriptors: \*Patents, \*Irrigation, \*Irrigation systems, \*Flow control, Irrigation practices, Irrigation efficiency, Valves, Application equipment.

An irrigation control system includes a rotary water motor operatively associated with valves to provide that the water motor is either in the full on or full off condition, dependent upon alignment of the irrigation line. The irrigation control system also includes a rotary water motor operatively associated with a valve, and a shut-down system is included for closing such valve upon loss of water pressure in a safety line. (Sinha - OEIS) W8D-00901

ROOT IRRIGATION DRIPILATOR DEVICE WITH SPRAY HEAD.

G. J. Konucik. U.S. Patent No 4,156,396, 3 p, 4 Fig, 19 Ref; Official Gazette of the United States Patent Office, Vol 982, No 5, p 1607, May 29, 1979.

Descriptors: \*Patents, \*Irrigation, \*Subsurface irrigation, \*Application equipment, Irrigation efficiency, Irrigation practices, Water delivery, Drip irri-

The object is to provide a root irrigation dripilator device which will provide irrigation to the roots of plants without wasting water upon the ground surface. The device consists of a main body with surface. In the device consists or a main body with perforated sleeve means for insertion into a ground surface, for the purpose of introducing a controlled amount of water and liquid fertilizer to plant roots underground. It includes a manually controlled valve, and is connectable in plurality with similar units that will receive liquids from a drum. (Sinha-OEIS) OEIS) W80-00905

TRAP MEANS FOR CENTER PIVOT IRRIGA-TION SYSTEM,

Rainmatic International, Ltd. Honolulu, HI. (As-

No. 3, Patent No. 4,156,504, 5 p. 3 Fig. 3 Ref; Official U.S. Patent No. 4,156,504, 5 p. 3 Fig. 3 Ref; Official Gazette of the United States Patent Office, Vol. 982, No. 5, p. 1644, May 29, 1979.

Descriptors: \*Patents, \*Irrigation, Irrigation systems, Pipelines, Pollutants, Irrigation efficiency, Irrigation practices, Equipment, Flushing, Particu-

An improved apparatus for flushing particulate matter from the pipeline of a center pivot irrigation system provides a length of downwardly extending pipe interposed in the pipeline in the immediate vicinity of or contiguous to the outermost mobile tower assembly of a plurality of such assemblies transporting the pipeline, permitting an operator standing on the ground to open the pipe during flushing. The downwardly extending pipe includes a restrictive opening for limiting the rate at which water is released from the pipeline during flushing. (Sinha - OEIS) V80-00906

AUTOMATIC IRRIGATION SYSTEM FOR CONTROL VALVE ASSEMBLY,

W. Stan. U.S. Patent No 4,158,441, 9 p, 8 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 983, No 3, p 535, June 19, 1979.

Descriptors: \*Patents, \*Irrigation, \*Irrigation systems, Irrigation practices, Irrigation efficiency, Flow control, Valves, Soil moisture.

The main water valve to an irrigation system is connected by a fulcrum arm to a float chamber with a float connected to the arm. When the water is 'on' a controlled feed gradually fills the float chamber which shuts off the water when the float chamber is full. At this point a controlled bleed valve in the bottom of the float chamber gradually empties the float chamber and turns on the water when the float chamber is emptied thus timing the empties the float chamber and turns on the water when the float chamber is emptied thus timing the 'on' cycle and the 'off' cycle. By closing the controlled feed and fully opening the bleed valve, the water level in the ground can raise and lower the float so that irrigation is by soil moisture content rather than by time. In another embodiment the water in the float chamber raises and lowers air pressure in a sensing tube which acts upon a diaphragm which in turn is operatively connected to the fulcrum arm. Once again the actuation can be on a time basis or by the moisture content of the soil. (Sinha-OEIS) W80-01184

LINEAR SPRINKLING IRRIGATION APPA-RATUS,

N. S. Standal.
U.S. Patent No 4,159,080, 20 p. 23 Fig. 13 Ref;
Official Gazette of the United States Patent Office,
Vol 983, No 4, p 758, June 26, 1979.

Descriptors: \*Patents, \*Irrigation, \*Irrigation sys-tems, \*Sprinkler irrigation, Irrigation practices, Ir-rigation efficiency, Application equipment, Lateral conveyance structures, Automatic control.

The irrigation apparatus is designed to automate sprinkling of a field by use of a wheel-supported lateral pipeline having sprinklers spaced along a center pipeline axis. The apparatus is alternately in a stationary mode adapted to be hydraulically coupled to the water supply line through a selected coupled to the water supply line through a selected water discharge valve, or in a traveling mode uncoupled from the water supply line and with the lateral pipeline powered for movement in a direction parallel to the supply line. The combination comprises a carriage guided along the water supply line, a structural fluid connection between supply line, a structural fluid connection between the lateral pipeline and the carriage and sensing means for indexing the carriage by reference to a selected water discharge valve. A valve acuator on the carriage complete a hydraulic circuit from the water supply line to the lateral pipeline through the structural fluid connection. The entire apparatus is controlled sequentially from the carriage. (Sinha-OEIS) W80-01187

### 4. WATER QUANTITY MANAGEMENT AND CONTROL

### 4A. Control Of Water On The Surface

AQUATIC HERBICIDAL DIACYLIMIDE COM-POSITIONS.

POSITIONS, GAF Corp., New York. (Assignee). L. Schneider, and D. E. Graham. U.S. Patent No 4,154,594, 4 p, 3 Tab, 4 Ref; Official Gazette of the United States Patent Office, Vol 982, No 3, p 1003, May 15, 1979.

Descriptors: \*Patents, \*Water treatment, Aquatic weed control, Herbicides, Organic compounds, Chemical reactions, Diacylimide compounds.

The invention provides broad spectrum herbicidal The invention provides broad spectrum herbicidal diacylimide compositions. The compositions show excellent agricultural herbicidal activity, particularly against foxtail millet, Japanese millet, crabgrass and pigweed, and aquatic herbicidal activity against lower and higher submerged aquatic plants. The diacylimide compounds generally are prepared by reacting a suitable amide with an acyladide precursor may be prepared, if necessary, from the corresponding acid by reaction with a suitable halogenating agent, such as thionyl chloride. Similarly, a given amide may be readily prepared, for example, from the corresponding acyl halide by reaction with ammonia. (Sinha-OEIS) W80-00894

PRE-MONSOON RAINFALL AND ITS VARI-ABILITY IN BANGLADESH: A TREND SUR-ABILITY IN BAN FACE ANALYSIS.

Windsor Univ. (Ontario). Dept. of Geography. For primary bibliographic entry see Field 2B. W80-01032

VEGETATION MANAGEMENT FOR WATER YIELD IMPROVEMENT IN THE COLORADO

Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.

A. R. Hibbert. A. K. FIDGET.

Available from the National Technical Information Service, Springfield, VA 22161 PB-300 379/AS, Price codes: A04 in paper copy, A01 in microfiche. Report, July 1979. 88 p, 13 Fig. 15 Tab, 129 Ref.

Descriptors: \*Water yield improvement, \*Colorado river basin, \*Watershed management, \*Snow management, \*Clear-cutting, \*Evapotranspiration control, Forest management, Land use, Brush, Forests, Runoff, Watersheds(basins).

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Kansas Fig, 2 P Descrip level 1 Aquifer wells, I saturati consoli Ogallal deposit

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Desci tionsl

### Identification Of Pollutants-Group 5A

Water yield from forest and rangelands can be augmented by managing vegetation and snow to reduce evapotranspiration. Methods of managing vegetation include clearing, type conversion, patch cutting, and thinning. Snow can be trapped in forest openings and by snow fences in windswept treeless areas to reduce evaporation of windblown snow and concentrate snowmelt to enhance its delivery to streams. Some arbitrary augmentation goals were chosen to illustrate the potential for increasing water yield, and treatments were hypothesized to get these increases. Most of the water produced by vegetation management would be cheaper than imported water, and some of it from commercial forests would be in the price range of water produced by weather modification. W80-01164

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### 4B. Groundwater Management

WATER-LEVEL CHANGES IN SOUTHWEST-ERN KANSAS, 1940-78, Geological Survey, Garden City, KS. Water Re-

M. E. Pabst, and E. D. Gutentag.
Kansas Geological Survey Journal, 1979. 29 p, 1
Fig. 2 Plates, 6 Tab, 28 Ref.

Descriptors: \*Water levels, \*Groundwater, \*Water level fluctuations, \*Irrigation wells, \*Kansas, Aquifer characteristics, Hydrogeology, Water wells, Pumping, Drawdown, Water table, Zone of saturation, Hydrologic data, Alluvial aquifers, Unconsolidated aquifers, °Southwestern Kansas, Ogallala formation, Undifferentiated pleistocene

From 1940 to January 1978, the number of irrigation wells in southwestern Kansas has increased from about 520 to 8,250, and estimated annual ground-water withdrawals have increased from 90,000 to 3,500,000 acre-feet. The principal wateryielding formations (unconsolidated aquifer) supplying water to wells are the Ogallala Formation of Pliocene age and the undifferentiated Pleistocene deposits. Water-level measurements are made each January, a time when there is little pumping. Water levels in wells in unconsolidated deposits have declined as much as 172 feet since 1940 in parts of southwestern Kansas, primarily as a result of ground-water withdrawals for irrigation. The median water-level decline from 1940 to January 1978, is 19 feet, and the median percentage decrease in saturated thickness is 11 percent. (Woodard-USGS) W80-00923

SUPPLYING WATER TABLE INTAKE THROUGH AGRICULTURAL USE OF URBAN

SEWAGE, Institute of Land Improvement in Green Lands, Wroclaw (Poland). For primary bibliographic entry see Field 5E. W80-00987

### 4C. Effects On Water Of Man's Non-Water Activities

QUANTITY AND QUALITY OF URBAN RUNOFF FROM THREE LOCALITIES IN THE DENVER METROPOLITAN AREA, Geological Survey, Lakewood, CO. Water Re-sources Div.

sources Div.

S. R. Ellis, and W. M. Alley.

Available from the National Technical Information
Service, Springfield, VA 22161 as PB-299 859,
Price codes: A04 in paper copy, A01 in microfiche.
Geological Survey Water-Resources Investigations
79-64, May 1979. 60 p. 25 Fig. 21 Tab, 17 Ref.

Descriptors: \*Urban runoff, \*Rainfall-runoff relationships, \*Storm runoff, \*Snowmelt, \*Water quality, Model studies, Water analysis, Chemical analysis, Heavy metals, Chlorides, Nitrogen, Colorado, \*Denver area.

Considerable variation in constituent concentra-tions was shown in urban runoff data for 1975-77 Considerable variation in constituent concentrations was shown in urban runoff data for 1975-77 from three metropolitan Denver drainage basins. Constituent concentrations, greatest during initial rainfall runoff, generally peaked midday of snowmelt runoff, corresponding with maximum melting and runoff. Instantaneous loads of constituents were largely a function of discharge. Days since last street sweeping or antecedent precipitation had no apparent effect; snowmelt-runoff loads apparently increased with number of days snow had been on the ground. Urban storm runoff may significantly contribute total ammonia nitrogen, total lead, and total zinc; and snowmelt runoff may significantly contribute sodium and chloride, to local receiving waters. Data from two basins were used for calibration and verification of U.S. Environmental Protection Agency's Storm Water Management Model II for rainfall-runoff modeling of flow and total nitrogen. The model assumption that land-surface loads of total nitrogen are directly proportional to number of days prior to storm during which accumulated rainfall was less than 1.0 inch was not substantiated. (Woodard-USGS) W80-00927

PARTIAL DROUGHT CONDITIONS IN NEPAL, Ground Water Resources Development Board,

Kathmandu (Nepal). For primary bibliographic entry see Field 2B.

### 4D. Watershed Protection

DUAL-PURPOSE DETENTION BASINS, Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst. For primary bibliographic entry see Field 5G. W80-00975

PRE-MONSOON RAINFALL AND ITS VARIABILITY IN BANGLADESH: A TREND SURFACE ANALYSIS, Windsor Univ. (Ontario). Dept. of Geography. For primary bibliographic entry see Field 2B. W80-01032

MODELS FOR PREDICTING WATER POLLUTION FROM AGRICULTURAL WATERSHEDS,

Science and Education Administration, Chickasha, OK. Southern Great Plains Watershed Research Center.
For primary bibliographic entry see Field 5C.

### 5. WATER QUALITY MANAGEMENT AND **PROTECTION**

### 5A. Identification Of Pollutants

MASOTEN (DYLOX) AS A CONTROL FOR CLAM SHRIMP IN HATCHERY PRODUC-TION PONDS,
Fish and Wildlife Service, San Marcos, TX. Fish

Cultural Development Center.

J. P. McCraren, J. L. Millard, and A. M. Woolven.
Proceedings of the Thirty-First Annual Conference Southeastern Association of Fish and Wildlife Agencies, Vol 31, p 329-331, 1977. 4 Ref.

Descriptors: "Shrimp, "Pesticide toxicity, "Fish management, Growth stages, Fry, Plankton, Benthic fauna, Fish hatcheries, Turbidity, Organo-phosphorus pesticides, Bioassay, Mortality, Bass, "Masoten.

Information relative to control of problematical clam shrimp with Masoten (Dylox) was accumulated over a 10 yr period at several Southwestern hatcheries. Laboratory and field studies showed that control could be achieved with single applica-

tions of Masoten as low as 0.01 mg/l (active ingredient). No deleterious effects on fry, fingerlings, or adult fish of several species were noted. Decomposition of the chemical, as well as effects on plankton and bottom fauna, are discussed. The paper places on record the efficacy of Masoten against clam shrimp, a level of treatment for same, and a suggested approach to control. (Deal-EIS) W80-00802

THE EFFECTS OF HEATED WATER ON WARMWATER FISH IN EARTHEN WARMWATER FISH IN EARTHEN RACEWAYS, Alabama Univ., Auburn. Dept. of Fisheries and

Allied Aquacultures.
For primary bibliographic entry see Field 5C.
W80-00803

EVALUATION OF AN AIR-BUBBLE CURTAIN TO REDUCE IMPINGEMENT AT AN ELECTRIC GENERATING STATION, Tenas Instruments Inc., Dallas, TX. Ecological

P. J. Zweiacker, J. R. Gaw, E. Green, and C.

Proceedings of the Thirty-First Annual Conference Southeastern Association of Fish and Wildlife Agencies, Vol 31, p 343-356, 1977. 8 Fig, 5 Tab, 21

Descriptors: \*Entrainment, \*Seasonal, \*Fish populations, Fish barriers, Fish behavior, Intakes, Powerplants, Water temperature, Cooling water, Growth stages, Thermal stress, Nuclear powerplants, Arkansas, Dardanelle Reservoir, \*Shad, Air bubble curtain.

A biological testing program was conducted during 1974-75 to determine the efficiency of an air-bubble curtain in reducing fish impingement at Arkansas Nuclear-One Unit 1, on Dardanelle Reservoir, AR. Air curtain operation did not effectively deter fish from entering the intake canal or substantially reduce impingement. Seasonal variations in species composition and length-frequency distribution of impinged fish were independent of air curtain operation. There was a significant inverse correlation between water temperature and impingement levels during fall 1974 and spring 1975. Highest impingement rates occurred during late fall, winter, and early spring, regardless of air curtain status. Impinged individuals were predominantly young-of-the-year-fish, especially threadfin (Dorsooma petenense) and gizzard shad (D. cepedianum), assumed to be thermally stressed by low (< 15.5 C) water temperatures. (Deal-EIS)

SALINITY STRESS AND SWIMMING PER-FORMANCE OF SPOTTED SEATROUT, Texas, Univ. at Austin, Port Aransas. Port Aransas Marine Lab.

Marine Lab.

J. M. Wakeman, and D. E. Wohlschlag.
Proceedings of the Thirty-First Annual Conference Southeastern Association of Fish and Wildlife Agencies, Vol 31, p 357-361, 1977. 3 Fig, 16 Ref.

Descriptors: \*Salinity, \*Toxicity, \*Fish behavior, Salt tolerance, Fish physiology, Water temperature, Saline water fish, Habitats, Statistical analysis, Laboratory tests, Stress, \*Seatrout, \*Cynoscion.

Specific swimming speeds of spotted seatrout (Cynoscion nebulosus) were linearly related (S = 0.16+0.93X) to tail-beats/sec (x) over speeds ranging from about 1.5 - 4.0 length/sec. Maximum ing from about 1.5 - 4.0 length/sec. Maximum sustained swimming speeds were measured at salinities ranging from 10 10 to 45 ppt in intervals of 5 ppt. At about 20 to 25 ppt, maximum sustained swimming speeds were close to 4 lengths/sec, but performance was reduced at salinities above or below this range. At 45 ppt, maximum sustained speeds were only about 2 lengths/sec. These results indicate that maximum sustained swimming performance can provide an effective method for evaluating salinity stresses. (Deal-EIS) W80-00805

EFFECTS OF MASOTEN (DYLOX) ON PLANK-TON IN EARTHEN PONDS,

### Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### **Group 5A—Identification Of Pollutants**

Fish and Wildlife Service, San Marcos, TX. Fish

rish and Wildlife Service, San Marcos, TX. Fish Cultural Development Center. J. P. McCraren, and T. R. Phillips. Proceedings of the Thirty-First Annual Confer-ence Southeastern Association of Fish and Wildlife Agencies, Vol 31, p 441-448, 1977. 6 Fig. 2 Tab, 13 Ref.

Descriptors: \*Pesticide toxicity, \*Phytoplankton, \*Zooplankton, Copepods, Rotifers, Crustaceans, Organophosphorus pesticides, Pesticide residues, Chemical degradation, Fish parasites, Bioassay, Fish management, Water chemistry, \*Masoten.

The effects of Masoten, an organophosphate parasiticide, on phytoplankton and zooplankton in earthen ponds were studied. In 2 separate trials, 3 ponds (0.04 ha) received a single application of Masoten at a rate of 0.25 mg/l (active ingredient) Masoten at a rate of 0.25 mg/1 (active ingredient) and 3 ponds served as untreated controls. Net plankton samples were collected at pre-treatment, and 5, 24 and 48 hrs following treatment. Toxic effects were based on quantitative-qualitative plankton analyses. Phytoplankton and rotifers were unaffected by treatment. The coppend Diaptomus sp. and nauplii were also unaffected. However, variability in response of copepods and nauplii to Masoten can be anticipated. Cladocerans were the most sensitive to Masoten; losses are to be expected when the compound is employed for expected when the compound is employed for control purposes. Information regarding residues and decomposition of Masoten is presented. (Deal-W80-00807

EFFECTS OF A PUMPED STORAGE HYDRO-ELECTRIC PLANT ON RESERVOIR TROUT HABITAT.

Fish and Wildlife Service, Clemson, SC. Southeast

rish and Wildlife Service, Clemson, SC. Southeast Reservoir Investigations. J. L. Oliver, P. L. Hudson, and J. P. Clugston. Proceedings of the Thirty-First Annual Confer-ence Southeastern Association of Fish and Wildlife Agencies, Vol 31, p 449-457, 1977. 4 Fig, 2 Tab, 12 Ref.

Descriptors: \*Trout, \*Toxicity, \*Thermal pollution. \*Thermocline, Habitats, Rainbow trout trout. Thermal stratification, Cooling water, Power-plants, Water temperature, Dissolved oxygen, South Carolina, Jocassee Reservoir, Hydroelectric plants, Pumped storage, Brown trout

Jocassee Reservoir is the upper pool for a 610-MW pumped storage hydroelectric plant in northwestern South Carolina. Trout have been stocked annually since 1972. The volume of trout habitat during summer has decreased annually from 1973 to 1976, and is associated with increases in the temperature and volume of water pumped from the lower reservoir. The top of the thermocline during September was lowered from about 9 m in 1973 to nearly 19 m in 1976, and trout habitat was reduced by about 65%. On the basis of a regression presented, we predict that trout habitat will be reduced to nil when plant operation reaches 63% of capacity (perhaps by 1981). (Deal-EIS)

EFFECT OF TEMPERATURE ON WALLEYE

EFFECT OF TEMPERATURE ON WALLEYE EGG HATCH RATE, Texas Parks and Wildlife Dept., Ingram. J. A. Prentice, and W. J. Dean, Jr. Proceedings of the Thirty-First Annual Confer-ence Southeastern Association of Fish and Wildlife Agencies, Vol 31, p 458-462, 1977. 1 Fig. 1 Tab, 9

Descriptors: \*Water temperature, \*Inhibition, \*Fish reproduction, \*Walleye, Toxicity, Heated water, Fish physiology, Fish management, Reservoirs, Spawning, Fecundity, Fish eggs, Thermal

This study was conducted to determine if water This study was conducted to determine it water temperature increases during the walleye (Stizostedion vitreum vitreum) spawning period reduced egg hatch rate and if water temperature manipulation during egg fertilization would increase hatch rate. Walleye eggs were subjected, before and during fertilization, to 1 of 3 treatments involving

water temperatures above and below 12C. Water temperatures above 12C were found to reduce temperatures above 12C were found to reduce hatch rates. Stripping and fertilizing eggs collected from reservoir water temperatures above 12C into water chilled to 7.2C significantly increased hatch rates. Use of this technique could improve walleye culture and management operations in some southern regions. (Deal-EIS)
W80-0809

REPRODUCTION REPRESSION OF LARGE-MOUTH BASS IN A HEATED RESERVOIR, TEASA PARKS and Wildlife Dept., San Antonio. W. J. Dean, and W. H. Bailey. Proceedings of the Thirty-First Annual Confer-ence Southeastern Association of Fish and Wildlife

Agencies, Vol 31, p 463-470, 1977. 1 Fig. 5 Tab, 31

Descriptors: °Fish reproduction, °Reservoirs, °Bass, Water quality, Spawning, Powerplants, Cooling water, Fish management, Inhibition, Fish physiology, Water chemistry, Growth stages, Mortality, Fish eggs, Texas, Victor Braunig lake, Calaveras Lake, Reproduction.

This study investigated possible factors inhibiting spawning of largemouth bass (Micropterus salmoides) in Victor Braunig Lake, a 547 ha power plant cooling reservoir in Bexar County, TX. Data plant cooling reservoir in Bear County, TX. Data on water quality, fish communities, pesticide and heavy metal concentrations and largemouth bass blood components and sexual development were analyzed from Braunig Lake and Calaveras Lake, a similar power plant lake nearby. All factors were similar between the 2 lakes. Largemouth bass from Braunig Lake began spawning 2 days after being moved to hatchery ponds. Largemouth bass from Calaveras Lake which had a normally reproducing population failed to spawn in pens in Braunig Lake. Braunig Lake largemouth bass had no chronic abnormalities that would inhibit spawning. Reproductive failure was apparently not due to chronic abnormalities that would inhibit spawning. Reproductive failure was apparently not due to poor water quality, over-abundance of other fishes, parasite infestations, unusual blood components, pesticide or heavy metal contamination, spawning substrate deficiencies or egg or fry mortality. The exact cause of the spawning repression was not identified. However, this study examined many factors associated with reproductive failure in largemently have and demograted a potential resemble. gemouth bass and demonstrated a potential prob-lem facing fishery managers of power plant lakes. In reservoirs where spawning does not occur, sup-plemental stockings will be necessary to sustain largemouth bass fisheries. (D-EIS) W80-00810

MIGRATION OF SAUGER PAST A THERMAL DISCHARGE IN MELTON HILL RESERVOIR, Tennessee Valley Authority, Norris. Div. of Forestry, Fisheries and Wildlife Development. R. W. Schneider, W. K. Wilson, and B. L. Evenhuis.

Proceedings of the Thirty-First Annual Conference Southeastern Association of Fish and Wildlife Agencies, Vol 31, p 538-545, 1977. 5 Fig, 2 Tab, 10

Descriptors: \*Sauger, \*Fish migrations, \*Heated water, Tennessee River, Fish physiology, Thermal pollution, Thermal powerplants, Outlets, Water temperature, Heat resistance, Seasonal, Tagging, Electro-fishing, Bull Run Steam Plant, Fish behav-

A total of 259 sauger (Stizostedion canadense) was A total of 259 sauger (Strzostedion canadense) was tagged and released downstream of Bull Run Steam Plant during the winters of 1974-75 and 1976. Gill nets and electrofishing gear were used to recapture sauger that moved into the discharge basin or past the plant. Over the study period 7 sauger were recaptured upstream from the discharge; 3 of these had moved past the plant while it was continuously operating. Fourteen sauger were caught in the discharge. The thermal plume from Bull Run Steam Plant had no significant effect on the movement of sauger. (Deal-ElS) W80-00811

EFFECTS OF GAS SUPERSATURATION ON FISH IN THE COLUMBIA RIVER,

National Marine Fisheries Service Seattle, WA. G. R. Snyder, R. J. McConnell, and T. H. Blahm. G. R. Snyder, R. J. McCollinell, and I. H. Blatim. In: Proceedings of the Symposium on Terrestrial and Aquatic Ecological Studies of the Northwest, March 26-27, 1976, EWSC Press, Cheney, Wash-ington, p 219-232. (1976) 6 Fig. 4 Tab, 8 Ref.

Descriptors: \*Supersaturation, \*Dissolved oxygen, Fish diseases, \*Gas-bubble disease, Dams, \*Columbia River, Bioassays, Nitrogen, Depth, Laboratory tests, Fish migrations, Juvenile fish, Swimming depth, Fish physiology, Fish behavior, Mortality, Chinook salmon, Coho salmon, Rainbow trout, Vertical distribution, Stress.

Tests have been conducted at the Prescott Field Facility of the National Marine Fisheries Service (NMFS) to determine effect of dissolved gas supersaturation on the survival of fish indigenous to the Columbia and Snake Rivers. Bioassay tests have Columbia and Shake Rivers. Blossay tests have provided information necessary to rank several species of fish by tolerance to gas supersaturation. Increased swimming depth enhances survival; therefore, the depth distribution of fish in the river therefore, the depth distribution of fish in the river was examined to accurately estimate fish mortality. A sonic detection array was developed and has been used to determine the swim-depth patterns of migrating juvenile salmonids. Tests conducted to determine if fish can detect and avoid gas supersaturated conditions indicated variation in nesnitivity among different species of salmonids. Exposure of selected species of fish to gas supersaturated and equilibrated water on an intermittent time basis indicated all species had better survival under these conditions than those exposed to constant high saturation conditions. Various physiological tests were conducted to determine effects of gas supersaturation on: (1) stamina, which was adsupersaturation on: (1) stamina, which was adversely affected, and (2) oxygen consumption, which increased under high gas concentrations, indicating stress. (Katz-EIS)

W80-00814

AUTOMATIC CULTURE SYSTEMS FOR GROWING LAMINARIA SACCHARINA (PHAEOPHYCEAE) AND TESTING THE EFFECTS OF POLLUTANTS,

Biologische Anstalt Helgoland, Hamburg (Germany, F.R.).

Inally, F. S., J.
J. W. Markham, K. Luning, and K-R. Sperling.
In: Proceedings of the Ninth International Seaweed Symposium, A. Jensen and J. R. Stein, Eds., Science Press, Princeton, p 153-159, 1977.
1 Fig. 5

Descriptors: \*Cultures, \*Phaeophyta, Plant growth, Growth rates, Bioassay, \*Bioindicators, Toxicity, Marine plants, Benthic flora, Analytical techniques, \*Cadmium, Heavy metals, Laminaria. \*Phaeophyta, passay, \*Bioindic

An automatic culture system has been developed to produce fast-growing young sporophytes of Laminaria saccharina of known age in a unialgal condition from stock cultures of gametophytes whenever required. Sporophytes 50-60 mm long can be produced in 7 wk. Sporophytes 7 wk old have been used in 6-day pollution experiments. In the continuous-flow system used for testing pollutants, the control plants increase their length by a factor of at least 3 during the 6 days. The growth rate of the plants subjected to pollution thus provides a sensitive parameter for the measurement of pollution effects and gives good reproducibility. pollution effects and gives good reproducibility. (Deal-EIS) W80-00817

EFFECT OF PULP MILL EFFLUENT ON PRODUCTIVITY OF SEAWEEDS,

Nova Scotia Research Foundation, Dartmouth K. Hellenbrand.

In: Proceedings of the Ninth International Seaweed Symposium, A. Jensen and J. R. Stein, Eds., Science Press, Princeton, p 161-171, 1977. 3 Fig, 9

Descriptors: \*Pulp wastes, \*Toxicity, \*Productivity, \*Marine plants, Pulp and paper industry, Photosynthesis, Respiration, Nutrients, Plant physiology, Tertiary treatment, Bioassay, Outlets, \*Fucus, \*Ascophyllum, \*Chondrus, \*Seaweeds.

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Identification Of Pollutants-Group 5A

The effect of treated kraft mill effluent on rates of aet photosynthesis and respiration of Chondrus crispus, Ascophyllum nodosum and Fucus vesiculosus was studied. Four types of experiments were carried out: (1) short (up to 14 days) and (2) long term (180 days) experiments in the laboratory with effluent concentrations of 2-50% and 0.5-2%, respectively. (3) In the field plants from an unpolluted site were transferred to sites near the effluent outfall and studied over a period of 4 mo. with effluent concentration 0.8-24%. (4) Plants growing near the outfall were compared with plants at an unpolluted control site. Under laboratory conditions, only Fucus showed reduced productivity in the presence of effluent. In the field productivity of all seaweeds was increased probably due to autrients in the effluent. It is concluded that with the described method it may be possible to detect subacute effects of effluents on seaweeds. (Deal-EIS) EIS) W80-00818

COMPOSITION OF BENTHIC MARINE ALGAE IN RELATION TO POLLUTION IN THE SETO INLAND SEA, JAPAN, Kobe Univ. (Japan). Dept. of Botany.

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In: Proceedings of the Ninth International Seaweed Symposium, A. Jensen and J. R. Stein, Eds., Science Press, Princeton, p 173-179, 1977. 2 Fig, 1

Descriptors: \*Marine algae, \*Bioindicators, Phaeophyta, Chemical oxygen demand, Industrial wastes, Municipal wastes, Water quality, Dominant organisms, Water chemistry, Chlorophyta, Rhodophyta, \*Species diversity, Japan, Seto Inland Sea.

As the pollution of the Seto Inland Sea has increased alarmingly, the change in the composition of benthic vegetation was investigated. The indicator algae that suggest water quality were identified. In the sea area of western Kobe the COD (chemical oxygen demand) is lowered gradually in a comparatively short distance. The present study showed that some brown algae (Dictyotaceae, Sargassaceae) were the least tolerant algae (COD < 1.5 ppm) and Ulvaceae (green algae) were the most tolerant (COD > 3.0 ppm). (Deal-EIS)

SENSITIVITY OF SOME BROWN ALGAL RE-PRODUCTIVE STAGES TO OIL POLLUTION, Environmental Research Lab., Narragansett, R.I. R. L. Steele, and M. D. Hanisak.

In: Proceedings of the Ninth International Sea-weed Symposium, A. Jensen and J. R. Stein, Eds., Science Press, Princeton, p 181-190, 1977. 5 Tab, 4

Descriptors: \*Oil pollution, \*Toxicity, \*Phaeo-phyta, \*Bioassay, Oil, Reproduction, Germination, Plant growth, Plant physiology, Spores, Resis-tance, \*Facus, \*Laminaria, Methodology.

Fucus and Laminaria are considered as bioassay organisms for oil as they are sensitive to oil, especially during gamete or spore release. Concentrations as low as 2 ppb blocked fertilization in Fucus, apparently due to toxic effects on the sperm. Laminaria spores did not germinate at concentrations above 20 ppb. Male gametophytes of Laminaria were more sensitive to oil than females, and sporophyte development was substantially decreased in the presence of oil. This study indicated not only the potential use of these species as bioassay organisms, but also that subtle ecological effects may be felt by the algal community in areas of chronic, low level oil pollution. (Deal-EIS) Fucus and Laminaria are considered as bioassay

UPTAKE, BIOTRANSFORMATION, DISPOSI-TION, AND ELIMINATION OF 2-METHYL-NAPHTHALENE AND NAPHTHALENE IN SEVERAL FISH SPECIES, Medical Coll. of Wisconsin, Milwaukee. Dept. of

Pharmacology.
M. J. Melancon, Jr., and J. J. Lech.
In: Aquatic Toxicology, ASTM STP 667, L. L.

Marking and R. A. Kimerle, Eds, American Society for Testing and Materials, p 5-22, 1979. 5 Fig. 5 Tab, 19 Ref.

Descriptors: \*Organic compounds, \*Path of pollutants, \*Fish physiology, Carbon radioisotopes, Tracers, Absorption, Chromatography, Chemical properties, Chemical analysis, Rainbow trout, Carp, Biodegradation, Animal metabolism, Enzymes, Sunfishes, \*Naphthalenes, \*Biotransformation, \*Tissue analysis, Methylnaphthalene.

tion, \*Tissue analysis, Methylnaphthalene.

The uptake, disposition, biotransformation, and elimination of 14C-2-methylnaphthalene and 14C-aphthalene have been studied in several species of fish. The half-lives of elimination of 14C from several tissues, following the exposure of rainbow trout fingerlings to both compounds for 8 h, were less than 24 h. After exposure of the trout to 14C-apthalene for four weeks, the half-life of elimination was hundreds of hours. After exposure to 14C-2methylnaphthalene for four weeks, the elimination of 14C was biphasic; the rapid phase of elimination of 14C was biphasic; the rapid phase of elimination had a half-life of less than 24 h while the half-life of the slow phase was hundreds of hours. Examination of the muscle 14C by thin-layer chromatography (TLC) suggested that differential elimination of the parent compound and its metabolites may be involved in these differences. The elimination of 14C from fingerling carp after four weeks of exposure to 14C-2-methylnaphthalene, was also biphasic. Bile 14C from rainbow trout, carp, and sheepshead which had been exposed to 14C-2-methylnaphthalene, was present mainly as metabolites. Most of the metabolites appeared to be conjugated when examined by TLC. (Deal-EIS) W80-00821

AN ASSESSMENT OF DDT TOXICITY ON OS-MOREGULATION AND GILL NA,K-ATPASE ACTIVITY IN THE BLUE CRAB, Emporia State Univ., KS. Div. of Biological Sci-

G. J. Neufeld, and J. B. Pritchard.
In: Aquatic Toxicology, ASTM STP 667, L. L. Marking and R. A. Kimerle, Eds. American Society for Testing and Materials, p 23-34, 1979. 3 Fig.

Descriptors: \*Pesticide toxicity, \*Osmosis, \*Crabs, \*DDT, Membrane processes, Animal physiology, Enzymes, Sodium, Potassium, Inhibition, Animal metabolism, Mode of action, Chemical analysis, Ion exchange, Crustaceans, Chlorinated hydrocarbon pesticides, \*Tissue analysis.

bon pesticides, "Tissue analysis."

The sodium, potassium adenosine triphosphatase (Na,K-ATPase) of the gill is responsible for the ability of the blue crab, (Callinectes sapidus), to maintain serum osmolality in dilute environments. Thus, the inhibition of this enzyme might lead to somoregulatory failure. To determine whether this mechanism plays a role in DDT toxicity in the blue crab, the effects of DDT on gill Na,K-ATPase activity and osmoregulation were examined in adult crabs. When DDT was presented to gill homogenates in vitro, Na,K-ATPase was significantly inhibited at a concentration of 1.0 ppm DDT. Essentially maximal inhibition occurred at 9.0 ppm. The injection of a sublethal dose of DDT (0.3 ppm) into the live animal produced a temporary decline in hemolymph osmolality. However, by 28 h after transfer of the animal to a dilute environment, the values for osmolality and Na,K-ATPase activity were virtually identical to those of controls. Since the intact animal had either (1) rapid induction, or activation, of new Na,K-ATPase activity or (2) excess sodium transport capacity protects the crab from osmoregulatory difficulty. (Deal-EIS)

ACEPHATE AND FENITROTHION TOXICITY IN RAINBOW TROUT: EFFECTS OF TEM-PERATURE STRESS AND INVESTIGATIONS ON THE STREOF ACTION, National Inland Fisheries Inst., Bangkok (Thai-land)

land).

M. Duangsawasdi, and J. F. Klaverkamp.
In: Aquatic Toxicology, ASTM STP 667, L. L.
Marking and R. A. Kimerle, Eds. American Soci-

ety for Testing and Materials, p 35-51, 1979. 8 Fig, 67 Ref.

Descriptors: \*Rainbow trout, \*Organic compounds, \*Pesticide, Toxicity, Path of pollutants, Mode of action, Water temperature, Thermal stress, Fish physiology, Enzymes, Inhibition, Phosphothioate pesticides, Chemical properties, Chemical analysis, Lipids, \*Acephate, \*Fenitrothion, \*Tissue analysis.

The detection of organophosphate (OP) insecticide pollution in natural waters requires knowledge of the physiological target sites and the mechanism of action of these chemicals in fish. This study was the physiological target sites and the mechanism of action of these chemicals in fish. This study was designed to determine the acute lethality of acephate (ATE), a phosphoramidothioate, and fenitrothion (FTN), a phosphorothionate, on rainbow trout fingerlings at three test temperatures; the sublethal effects of ATE and FTN on heart rate (HR), ventilation rate (VR), buccal amplitude (BA), and cough frequency (CF) in adult rainbow trout; and the effects of ATE and FTN on the brain, erythrocyte, gill, heart, serum, and skeletal muscle cholinesterase inhibition (ChEI) in these fish. From our results, the LC50 values of ATE were approximately 600 to 1000 times greater than those of FTN. Temperature affected the LC50 values, median survival times, and slopes of mortality curves of FTN, but not those of ATE. Both insecticides produced a decrease in HR, and an increase in VR and BA. FTN produced an increase in CF, but ATE did not. The cholinesterase activity in the erythrocytes, gill, heart, and serum showed marked inhibition after 3 h of exposure to ATE, compared with 1 h of exposure to FTN. More time was required to attain maximal inhibition in the brain and skeletal muscle than in other issues. This study indicates that the cardiovascular and resultative and resultance in increase in inportant sites. tion in the brain and skeletal muscle than in other tissues. This study indicates that the cardiovascular and respiratory systems in fish are important sites of action for OP toxicity, and that this toxicity depends on physicochemical properties, for example, lipid solubility, and on environmental factors, for example, temperature. (Deal-EIS) W80-00823

RELATIONSHIP OF THE PHYSIOLOGY OF AQUATIC ORGANISMS TO THE LETHALITY OF TOXICANTS: A BROAD OVERVIEW WITH EMPHASIS ON MEMBRANE PERMEABIL-

son Univ., SC. Dept. of Environmental Systems Engineering.

B. Katz.

B. Natz.
In: Aquatic Toxicology, ASTM STP 667, L. L. Marking and R. A. Kimerle, Eds, American Society for Testing and Materials, p 62-76, 1979. 11 Fig, 35 Ref.

Descriptors: \*Membrane processes, \*Toxicity, \*Ammonium compounds, Ammonia, Biological membranes, Chlorine, Heavy metals, Osmosis, \*Zinc, \*Cadmium, \*Copper, Nickel, Sodium, Permeability, Chemical properties, Mode of action, \*Gills, \*Tissue analysis, Fish physiology, Membrane permeability.

A mechanism is proposed to explain differences in acute toxicity to different species caused by substances that form stable ammonia complexes. These substances include chlorine and various heavy metals. A deficiency in osmoregulation, resulting in damage to the gill but not the skin epithelia, is discussed in relation to varying degrees of toxicity affecting a wide spectrum of aquatic organisms. (Deal-EIS) W80-00825

RESPIRATORY ACTIVITY OF FISH AS A PREDICTOR OF CHRONIC FISH TOXICITY VALUES FOR SURFACTANTS, Proctor and Gamble Co., Cincinnati, OH. Ivory-

Adale Technical Center.

A. W. Maki.

In: Aquatic Toxicology, ASTM STP 667, L. L.

Marking and R. A. Kimerle, Eds, American Society for Testing and Materials, p 77-95, 1979. 6 Fig,

7 Tab, 28 Ref.

Descriptors: \*Surfactants, \*Bioassay, \*Sunfishes, Methodology, Analytical techniques, Toxicity,

### Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A-Identification Of Pollutants

Fish physiology, Respiration, Water quality, Monitoring, Organic compounds, Linear alkylate sulfonates, \*MATC.

A system was developed to monitor the ventilation frequency of bluegills (Lepomis macrochirus) under continuous-flow exposure to test compounds. The nerve-action potential associated with the opening and closing of the cbuccal cavity, branchial arches, and operculum was simultaneously monitored for 16 fish, four each from three exposure concentrations and four controls. The system was used to desemble the effects of several exposure concentrations and four controls. The system was used to determine the effects of several representative surfactants on the diurnal respiratory activity of the test fish. The test compounds were selected on the basis of previously existing full-life-cycle chronic fish data with which to compare the respiratory data. Good correlations are demonstrated between the chronic maximum acceptable toxicant concentration for fathead minceptable toxicant concentration for fathead minows and the concentrations of surfactants that elicit statistically significant changes in the diurnal ventilation frequencies of exposed bluegills. A simplified statistical procedure, employing the log 10 of observed rates, was developed, allowing determination of the changes in rates over the entire day and night exposure periods. It appears that the monitoring of aberrant respiratory activity in bluegills for a two-day need has potential predictive. gills for a two-day period has potential predictive value as a scanning tool for a rapid prediction of chronic fish toxicity values. (Deal-EIS)

USE OF LUMINESCENT BACTERIA FOR DETERMINING TOXICITY IN AQUATIC ENVI-RONMENTS.

Beckman Instruments, Inc., Carlsbad, CA.

A. A. Bulich. A. A. Bullen. In: Aquatic Toxicology, ASTM STP 667, L. L. Marking and R. A. Kimerle, Eds, American Soci-ety for Testing and Materials, p 98-106, 1979. 3 Fig, 3 Tab, 3 Ref.

Descriptors: \*Bioassay, \*Bioluminescence, \*Toxicity, \*Organic compounds, Monitoring, Methodolo¿v, Analytical techniques, Bacteria, Surfactants,
% ter quality, Light intensity, \*Chlordane, \*Pentachlorophenol, \*Čarbon tetrachloride.

A simple rapid method for monitoring the toxicity of aquatic samples has been developed. The assay is based on changes in the light output of luminescent bacteria, as measured in a photometric device. Under suitable conditions, selected strains of luminescent bacteria emit a constant amount of light as a metabolic byproduct. On exposure to toxicants, a metaonic opticate: on exposure of totacants, the light intensity is quickly diminished by an amount which is proportional to the concentration of the toxicant. An initial comparison of this new method with a 96-h acute fish toxicity test suggests method with a 90-h acute han toxicity test suggests that the bacterial test compares favorably in sensitivity with other tests while being more simple and rapid to perform. Data can be obtained in two to five minutes. Some examples of demonstrated senstivities (in mg/litre) are: pentachlorophenol, 0.005; carbon tetrachloride, 6.0; sodium lauryl sultate, 1.0; chlordane, 0.6; and sodium hypochlorite, 0.005. (Deal-EIS) W80-00827

TAINT THRESHOLD OF DIPHENYL OXIDE

IN RAINBOW TROUT,
Dow Chemical Co., Midland, MI. Environmental
Sciences Research Lab.
D. R. Branson, G. E. Blau, H. C. Alexander, and

D. R. Branson, U. E. Biau, H. C. Ricaanuci, and T. L. Peters. In: Aquatic Toxicology, ASTM STP 667, L. L. Marking and R. A. Kimerle, Eds, American Soci-ety for Testing and Materials, p 107-121, 1979. 4 Fig. 3 Tab, 1 Append, 12 Ref.

Descriptors: \*Rainbow trout, \*Bioindicators, \*Taste, Chemical analysis, Path of pollutants, Fish physiology, Chemical wastes, Chemical properties, Organic compounds, Water quality, \*Diphenyl oxide, \*Fish-taint test, \*Tissue analysis, \*Bioaccu-

Rainbow trout were exposed continuously for seven days to sublethal concentrations of diphenyl oxide (DPO) in water. The trout flesh was then

analyzed for taste and DPO concentrations. The following conclusions were based on the experimental results: (1) Trout flesh containing 7.5 + or - 1.2 micrograms/g DPO was identified by a panel as characterizing the breakpoint between tained and untainted taste. Trout exposed continuously to 16 micrograms/litre of DPO in the water for one week show flesh concentrations of DPO that corweek show flesh concentrations of DPO that cor-respond to this fish-taint threshold. (2) The DPO concentrations in trout flesh increased 1.75 times after baking. This phenomena could be due to water loss and to possible transfer of DPO from the skin to the flesh during baking. Cooked trout flesh containing 13 + or - 2 micrograms/g DPO were at the fish-taint threshold. (3) A statistically significant correlation was obtained between fish-taint scores and the DPO concentration in flesh, which permits the prediction of fish taint to be made from a given DPO residue in fish. (4) Statisti-cal analysis of the taste data indicated that neither taste fatigue not taster experience was a factor in taste fatigue nor taster experience was a factor in this study. (5) This study illustrates that taint in fish can be one of the more sensitive water quality criteria for some chemicals. (Deal-EIS) W80-00828

VALUE OF CHEMICAL FRACTIONATION FOR IDENTIFYING THE TOXIC COMPO-NENTS OF COMPLEX AQUEOUS EF-FLUENTS

FLUENTS,
Oak Ridge National Lab., TN.
B. R. Parkhurst, C. W. Gehrs, and I. B. Rubin.
In: Aquatic Toxicology, ASTM STP 667, L. L.
Marking and R. A. Kimerle, Eds, American Society for Testing and Materials, p 122-130, 1979. 2
Tab, 12 Ref.

Descriptors: \*Analytical techniques, \*Bioassay, \*Daphnia, \*Toxicity, Chemical analysis, Chemical wastes, Fuels, Coals, Acids, Alkalis(Bases), \*Synthetic fuels.

Chemical fractionation can be used to separate Commicial fractionation can be used to separate complex aqueous effluents into several less complex fractions. This technique has been combined with mutagenesis testing to provide an effective means of screening the potential health hazards of products and of aqueous effluents. The purpose of this study was to evaluate the applicability of combining chemical fractionation with acute toxicity testing as a method of identifying and quantitative-ly assessing those components of a synthetic fuel process effluent that are toxic to aquatic biota. A representative synthetic fuel effluent was fractionated into three organic fractions (acid, base, and neutral) and an inorganic fraction. The original effluent, the fractions, and a reconstituted effluent were tested for acute toxicity to Daphnia magna. The results demonstrated that (1) the neutral fraction was the most toxic; (2) the acid and neutral fractions contributed the most toxicity, 51.3 and tractions controlled the most toxicity, 51.3 and 41.9 percent, respectively, to the toxicity of the whole effluent; (3) the toxicities of the four fractions were additive; and (4) the fractionation process did not significantly alter the toxicity of the effluent. Possible applications of this approach, as well as its limitations, are discussed. (Deal-EIS) W80-00829

A CHRONIC TOXICITY TEST WITH THE MARINE COPEPOD ACARTIA TONSA, United States Testing Co., Inc., Hoboken, NJ. T. J. Ward, E. D. Rider, and D. A. Drozdowski. In: Aquatic Toxicology, ASTM STP 667, L. L. Marking and R. A. Kimerle, Eds, American Society for Testing and Materials, p 148-158, 1979. 3 Fig, 4 Tab, 13 Ref.

Descriptors: \*Bioassay, \*Copepods, \*Life cycles, Methodology, Zooplankton, Growth stages, Animal physiology, Reproduction, Toxicity, Chemical wastes, Productivity, Laboratory test, Marine zooplankton, Crustaceans, \*Acartia.

A chronic toxicity test was developed for studying the effects of five toxicants (effluents) on the survival and reproduction of Acartia tonsa, a marine zooplankton. The test involves the exposure of copepods to three concentrations of each material (320, 100, and 32 ppm) for an entire life cycle. It is divided into three parts: (1) the reproduction of

laboratory-cultured A. tonsa in breeding chambers containing the three concentrations of toxicants under static conditions; (2) sexual maturation of the F1 organisms in the toxicant concentrations under flow-through conditions; and (3) the reproduction of the F1 organisms under the same conditions as those established for Part 1, and the monitoring of the organisms' reproductive success, defined as the number of viable F2 offspring. The results of the chronic tests were compared with data from an acute study conducted earlier. The chronic tests showed a significant reduction in organism survival, when compared with the acute tests (in the al, when compared with the acute tests (in the range of 1.0 to 0.1 percent of the 48-h LC50 value). This paper highlights the relative simplicity of the chronic A. tonsa test procedure and demonstrates its twofold usefulness: (1) in the identification of a long-term effect and (2) in the comparison of the chronic toxicity of differing materials. (Deal-EIS)

USE OF THE GRASS SHRIMP (PALAEMON-ETES PUGIO) IN A LIFE-CYCLE TOXICITY

Environmental Research Lab., Gulf Breeze, FL. D. B. Tyler-Schroeder.

In: Aquatic Toxicology, ASTM STP 667, L. L. Marking and R. A. Kimerle, Eds, American Society for Testing and Materials, p 159-170, 1979. 2 Fig, 3 Tab, 25 Ref.

Descriptors: \*Shrimp, \*Bioassay, \*Pesticide toxicity, Methodology, Growth stages, Chlorinated hydrocarbon pesticides, Endrin, Larval growth stage, Life cycles, Reproduction, Juvenile growth stage, Animal physiology, \*MATC.

A methodology for using the estuarine grass shrimp in life-cycle toxicity tests was successfully developed. Life-cycle exposures of juvenile shrimp developed. Life-cycle exposures of juvenile shrimp to the chlorinated hydrocarbon pesticide endrin were begun in November 1976 and completed in March 1977. After the juveniles matured and spawned, the effects on their progeny were determined. The average measured exposure concentrations were 0 (control), 0.03, 0.05, 0.11, 0.18, 0.38, and 0.79 micrograms endrin/litre seawater. The juveniles reached sexual maturity during the first two weeks of the exposure. Thereafter, a photoperiod regime was used to induce reproduction, and the effects of endrin on the survival, growth, and reproduction of the parent generation were deter-mined. Larvae spawned by control and exposed mined. Larvae spawned by control and exposed parents were continuously exposed until the juvenile state. The effects on survival, length of larval development, and growth of the F1 generation were determined. The 96-h LCS0 for juvenile grass shrimp was 0.35 micrograms endrin/litre water. In the life-cycle toxicity test, gonadal development and spawning were inhibited at 0.03 micrograms endrin/litre water. Because this was the lowest concentration tested the maximum allowable toxic concentration tested, the maximum allowable toxicant concentration could not be determined. The cant concentration could not be determined. I he specific application factor for grass shrimp is, therefore, less than 0.08, approximately one order of magnitude lower than those generated in lifecycle tests exposing freshwater and estuarine fishes to endrin. (Deal-EIS)

A METHOD FOR MEASURING ALGAL TOXICITY AND ITS APPLICATION TO THE SAFETY ASSESSMENT OF NEW CHEMICALS, Proctor and Gamble Co., Cincinnati, OH. Environmental Safety Dept.
A. G. Payne, and R. H. Hall.

In: Aquatic Toxicology, ASTM STP 667, L. L. Marking and R. A. Kimerle, Eds, American Society for Testing and Materials, p 171-180, 1979. 4 Fig. 7 Ref.

Descriptors: \*Analytical techniques, \*Algae, \*Bio-assay, Monitoring, Methodology, Chemical prop-erties, Growth rates, Toxicity, Algicides, Chloro-phyta, Cyanophyta, Diatoms, Dinoflagellates, Sur-factants, Productivity.

An algal toxicity test has been developed specifi-cally for use in the environmental safety assess-ment of new chemicals. The test is based on the Algal Assay Procedure (Bottle Test) but has been

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Identification Of Pollutants—Group 5A

modified in order to make the procedure useful for toxicity assessment. A five-day exposure of freshwater or marine uni-algal cultures to a range of test material concentrations is followed by a nine-day recovery period in the absence of the test material. Cell counts or in vivo fluorescence measurements made during the study allow the quantification of toxic responses ranging from reduced growth, through the algistatic response, to the algicidal response. The primary toxicity effect sought in this method is the algistatic response, which is both easily determined and environmentally meaningful. The algistatic concentration of a test material, as derived by this method, is the concentration that causes no net change in cell number after chronic derived by this method, is the concentration that causes no net change in cell number after chronic exposure but permits regrowth when the cells are resuspended in fresh media without the test material. The environmental significance of this type of measurement relative to other measurements of algal toxicity is discussed. (Deal-EIS) W80-00832

UPTAKE, DEPURATION, AND TOXICITY OF HEXAMETHYLPHOSPHORAMIDE IN AQUATIC ORGANISMS, Haskell Lab. for Toxicology and Industrial Medi-

cine, Newark, DE. P. W. Schneider, Jr., J. R. Gibson, G. C. Cramm,

nd S. P. Shrivastava.

In: Aquatic Toxicology, ASTM STP 667, L. L. Marking and R. A. Kimerle, Eds, American Society for Testing and Materials, p 181-192, 1979. 1 Fig. 5 Tab, 17 Ref.

Descriptors: \*Toxicity, \*Bioassay, \*Organic compounds, Industrial wastes, Chemical wastes, Daphnia, Sunfishes, Oysters, Minnows, Chemical analysis, Absorption, Mortality, Path of pollutants, Animal metabolism, \*Tissue analysis, \*Bioaccumulation, \*Carcinogens, \*Hexamethylphosphoramide, \*Popuration.

Aquatic toxicity tests were undertaken to evaluate the environmental significance of hexamethylphosphoramide Hexamethylphosphoramide's 48-h LC50 to Daphnia and 96-h LC50 to bluegill sunfish were 4220 mg/litre and 7420 mg/litre, respectively. In concentrations up to and including 5140 mg/litre, HMPA did not interfere with the normal development of Fastern overset where the the valies. ment of Eastern oyster embryos to the veliger stage. Both sheepshead minnows and Eastern oys-ters developed concentrations of HMPA in their tissues rapidly from 0.5, 8.4, and 40.4 mg/litre tissues rapidly from 0.5, 8.4, and 40.4 mg/litre treatments, with the plateau concentrations rarely exceeding the exposurel concentrations. Wholebody residues peaked in about three to seven days after the initiation of exposure. Sheepshead minnows demonstrated a greater ability to metabolize HMPA than oysters, while oysters depurated HMPA and its metabolites more rapidly than fish. Both species largely eliminated HMPA and its metabolites within one day of depuration. The bioconcentration factors for fish and oysters were less than four, which suggests that HMPA does not pose a substantial environmental hazard from the standpoint of its accumulation in aquatic organical contents. not pose a substantial environmental nazard from the standpoint of its accumulation in aquatic organ-isms. The oyster mortality in the 8.4 and 40.4 mg/ litre treatments was similar among all the treat-ments and the control. (Deal-EIS) W80-00833

CONCENTRATION OF ELEMENTS IN MARINE ORGANISMS CULTURED IN SEAWATER FLOWING THROUGH COAL-FLY

Woods Hole Oceanographic Institution, MA.
J. Ryther, T. M. Losordo, A. K. Furr, T.
Parkinson, and W. Gutenman.
Bulletin of Environmental Contamination and
Toxicology, Vol 23, p 207-210, 1979. 2 Tab, 21

Descriptors: \*Water chemistry, \*Industrial wastes, \*Path of pollutants, Chemical analysis, Trace elements, Clams, Oysters, Worms, Coals, Electric powerplants, Aluminum, Bromine, Calcium, Cobalt, Iron, Magnesium, Zinc, \*Arsenic, \*Fly ash, \*Tissue analysis, \*Bioaccumulation, \*Seleni-

Fly ash has been studied as a material to add to lakes to decrease the phosphorus concentration by fixation and thereby hopefully limit algal growth. In the work reported, marine organisms were cultured in seawater flowing through a bed of coal fly ash. The organisms were then analyzed for 40 elements by neutron activation and other methods. The organisms cultured and studied were soft The organisms cultured and studied were: soft shell clams (Mya arenaria), hard shell clams (Mersneil clams (Mya arenaria), nard sneil clams (Mer-cenaria mercenaria), American oysters (Crassos-trea virginica) and sand worms (Nereis virens). Values for elemental concentrations in fly sah and marine organisms were presented. Of the 40 ele-ments studied, arsenic and selenium were of most concern because of their relative toxicity. (Deal-W80-00834

DISTRIBUTION OF BENTHOS IN RELATION TO THE SULFIDE-CONTENT IN THE BOTTOM SEDIMENTS OF MIXO-POLYHALINE LAKE NOTORO, HOKKAIDO,

Hokkaido Univ., Hako-date (Japan). Lab. of Marine Culture.

S. Nakao. Bulletin of the Faculty of Fisheries of Hokkaido University, Vol 29, No 3, p 199-212, 1978. 12 Fig, 3 Tab, 23 Ref.

Descriptors: \*Dredging, \*Sulfides, \*Benthic fauna, Biological communities, Dissolved oxygen, Sea water, Bottom sediments, Water chemistry, Channel improvement, Invertebrates, Seasonal, Water temperature, Chlorination, \*Polychaetes, \*Species dissertion.

Changes are described in the macrobenthic fauna in Lake Notoro in response to the enrichment of dissolved oxygen of bottom water and the diminu-tion of total sulfide content in the bottom sedition of total sulfide content in the bottom sediments, brought about by quantities of the inflow from outer sea water through an artificially constructed mouth. The dredging and enlarging of the outlet resulted in a better aeration of deeper water at all seasons and a wider distribution of benthic animals. The total sulfide content in the bottom sediments where no benthos had been found before this artificial construction decreased rapidly. In deeper water of better aeration the benthic community, though showing a low diversity value, was newly found in the bottom with such high content as 4.27 ppr in total sulfide. The index values of benthic communities increased with decreasing total sulfide content and showed a rapid rate of increase in total sulfide amount smaller than 1 ppt. (Deal-EIS)

ACUTE TOXICITY OF VANADIUM TO TWO SPECIES OF FRESHWATER FISH,

University of Southern California, Los Angeles. Dept. of Biological Sciences. B. K. Knudtson.

Bulletin of Environmental Contamination and Toxicology, Vol 23, p 95-99, 1979. 1 Tab, 11 Ref.

Descriptors: \*Toxicity, \*Bioassay, Fish physiology, Trace elements, Mortality, \*Freshwater fish, Lethal limit, Ammonium compounds, Sodium compounds, Metals, Chemical properties, \*Vanadium, \*Vanadium compounds, Goldfish, Guppies, Carassius, Lebistes.

Static bioassays for acute vanadium toxicity were performed using goldfish (Carassius auratus) and guppies (Lebistes reticulatus). Sodium metavanadate, ammonium metavanadate, vanadyl sulfate, and vanadium pentoxide were tested separately. 144-h LC50 values for C. auratus were 2.45, 3.82, 2.95 and 8.08 ppm, respectively. Similarly, L. reticulatus values were 0.49, 1.49, 0.37 and 1.05 ppm. In general, these results indicate that, with the possible exception of ammonium metavanadate, there is an obvious differential sensitivity to vanadium compounds between the two species. In addition, they suggest that intraspecific sensitivity to the various compounds is substantially less than interspecific sensitivity. (Deal-EIS) W80-00836

TOXICITY OF FOUR SYNTHETIC PYRETH-ROID INSECTICIDES TO RAINBOW TROUT, Guelph Univ. (Ontario). Dept. of Environmental

Biology.

J. R. Coats, and N. L. O'Donnell-Jeffery.

Bulletin of Environmental Contamination and Toxicology, Vol 23, p 250-255, 1979. 1 Fig. 2 Tab,

Descriptors: \*Pesticide toxicity, \*Rainbow trout, Insecticides, Mortality, Mosquitoes, Fish physiology, Fry, Chemical properties, Organic pesticides, Bloassay, Toxicity, \*Pyrethroid pesticides, \*Permethrin, \*Cypermethrin, \*Fenvalerate, \*Fenpro-

Synthetic pyrethroids constitute a new group of very potent insecticides. Fish toxicity is of particular concern in view of the potential use of these insecticides in aquatic habitats as they have demonstrated excellent activity against mosquito larvae. The current investigation assesses the toxicity of 4 experimental photostable pyrethroids to fingerling rainbow trout. The LC50 values for permethin, cypermethin, fenvalerate and fenpropanate were 133, 55, 76 and 76.7 ppb, respectively, for the technical grade product and 61, 11, 21 and 8.6 ppb for the formulated product. (Deal-EIS)

EMBRYOTOXIC EFFECTS OF CRUDE OIL CONTAINING NICKEL AND VANADIUM IN MALLARDS,
Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.

D. J. Hoffman.
Dulletin of Environmental Contamination and Toxicology, Vol 23, p 203-206, 1979. 1 Tab, 12 Ref.

Descriptors: \*Nickel, \*Oil, \*Toxicity, \*Mallard ducks, Embryonic growth stage, Bird eggs, Oil pollution, Growth rates, Mortality, Animal physiology, \*Vanadium, \*Crude oil.

The addition of relatively high concentrations of vanadium or nickel porphyrin compounds to a crude oil that only contained trace amounts of vanadium and nickel did not significantly increase mallard embryonic mortality above the level caused by the crude oil alone. However, embryonic mortality appeared slightly greater in the presence of vanadium or nickel and it is possible that this effect might be amplified with a lower does of oil. The temporal pattern of embryonic mortality did not differ in the presence of added vanadium or nickel. (Deal-EIS)

W80-00838

EVIDENCE FOR THE PROTECTIVE EFFECT OF METALLOTHIONEINS AGAINST INOR-GANIC MERCURY INJURIES TO FISH, Liege Univ. (Belgium). Lab. d'Oceanogolie. J. M. Bouquegneau. Bulletin of Environmental Contamination and Toxicology, Vol 23, p 218-219, 1979. 1 Fig. 5 Ref.

Descriptors: \*Mercury, \*Toxicity, \*Eels, Animal metabolism, Animal physiology, Mortality, Inhibition, \*Cadmium, Heavy metals, Sea water, Water chemistry, \*Metallothioneins.

In order to test the hypothesis of a protective role of metallothioneins, we have compared the toxicity of a lethal dose of mercury (10 ppm) on sea water adapted eels using animals whose gills contained or did not contain metallothioneins, depending on the treatment to which they had been submitted. A preintoxication with a sublethal dose of HgC12, which induces the synthesis of metallothioneins in the gills, reduces the toxicity of the lethal dose of 10 ppm. That dose is even less toxic when the eels have been preintoxicated by a sublethal dose of CdC12. In this case, CdC12 induces the synthesis of metallothioneins in eel's gills which bind all the cadmium present in the tissue. (Deal-EIS) W80-00839

ENVIRONMENTAL BROMINE IN FRESH-WATER AND FRESHWATER ORGANISMS: FACTORS AFFECTING BIOACCUMULATION,

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### Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### **Group 5A—Identification Of Pollutants**

Middle Tennessee State Univ., Murfreesboro. Dept. of Chemistry and Physics. A. E. Woods, R. F. Carlton, M. E. Casto, and G. I.

Bulletin of Environmental Contamination & Toxicology, Vol 23, p 179-185, 1979. 3 Fig. 2 Tab, 5

Descriptors: "Bromine, "Sewage effluents, Fish-kills, Path of pollutants, Crayfish, Freshwater fish, Chemical analysis, Wastewater treatment, Chlo-rine, Chlorination, Sunfahes, Toxicity, Mortality, "Tissue analysis, "Bioaccumulation.

While studying fishkills it was noted that bromine levels in organisms varied greatly in the study area. Samples taken from above a municipal sewage outlet were relatively high in bromide while those immediately below had negligible bromide levels. It was concluded that the depletion of bromide was due to the addition of chlorine to the wastewater effluent. This created an oxidizing environment which inhibited bromine bioaccumulation. (Deal-EIS)

IDENTIFICATION OF THE HERBICIDE 2,4,6-TRICHLOROPHENYL P4-NITROPHENYL ETHER IN IMPORTED RAINBOW TROUT, Food and Drug Administration, Brooklyn, NY. F. M. Gretch, T. L. Barry, G. Petzinger, and J.

Bulletin of Environmental Contamination & Toxicology, Vol 23, p 165-169, 1979. 2 Fig, 2 Tab, 5

Descriptors: \*Pesticide residues, \*Rainbow trout, \*Pollutant identification, Path of pollutants, Chloriated hydrocarbon pesticides, Herbicides, Pesticide kinetics, Chemical properties, Chemical analysis, Gas chromatography, Analytical techniques, \*Tissue analysis, \*2,4,6-trichlorophenyl-p-nitro-\*Tissue analysis, phenyl ether, Japan.

A sample of frozen rainbow trout imported from Japan was examined for posticide Japan was examined for pesticide residues. The trout was found to contain an unknown compound. Low resolution gc-ms analysis of the sample ex-tract was used to determine that the molecular tract was used to determine that the molecular weight of the unknown compound was 317, that it contained three chlorine atoms and that it contained an odd number of nitrogen atoms. The fragmentation pattern was similar to that of the herbicide nitrogen (2.4-dichlorophenyl-p-nitrophenyl ether), C12H7C12NO3, suggesting a similar phenyl ether), CÎ2H7Cl2NO3, suggesting a similar structure. The unknown component was tentative-ly identified as a trichloro-nitro-phenyl ether (C12H6Cl3NO3). The structure of the unknown was confirmed by obtaining accurate mass measurements and elemental composition data using double beam gc-ms. A search of the literature led to references on a relatively new herbicide, 2,4,6-trichloro-phenyl-p-nitrophenyl ether, tradenamed MOR. A reference standard of this compound was obtained from the manufacturer, and the identity of the unknown component in the sample was confirmed by retention time and mass spectral data. (Deal-EIS)

ACUTE ENDRIN TOXICITY ON OXIDASES OF OPHIOCEPHALUS PUNCTATUS (BLOCH), Hindu Coll., Moradabad (India). Dept. of Zoo-

logy.
S. K. Sharma, L. D. Chaturved, and K. V. Sastry.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 153-157, 1979. 2 Tab, 14 Ref.

Descriptors: "Pesticide toxicity, "Endrin, "En-zymes, "Inhibition, Fish physiology, Toxicity, Mortality, Animal metabolism, Biochemistry, Chemical analysis, Mode of action, Chlorinated hydrocarbon pesticides, "Tissue analysis.

The acute effects of endrin on enzyme activities was studied in Ophiocephalus punctatus. Exposure to five different endrin concentrations for 96-h was to five different endrin concentrations for 96-n was found to decrease the activity of succinic, pyruvic and lactic dehydrogenases in liver and kidney. The diminished enzyme activities may be due either to decreased synthesis of enzymes in the tissues or to damage of cytoplasmic organelles. (Deal-EIS) W80-00842

DISTRIBUTION OF RADIOACTIVITY IN COALFISH (POLLACHIUS VIRENS) FOL-LOWING INTRAGASTRIC ADMINISTRATION OF (9-14C) PHENANTHRENE,

Bergen Univ. (Norway). Inst. of Fisheries Biology. J. E. Solbakken, K. H. Palmork, T. Neppelberg, and R. R. Scheline.

Bulletin of Environmental Contamination & Toxi-cology, Vol 23, p 100-103, 1979, 1 Tab. 6 Ref.

Descriptors: \*Path of pollutants, \*Tracers, \*Organic compounds, Radiochemical analysis, Carbon radioisotopes, Fish physiology, Animal metabolism, Aromatic compounds, Chemical properties, Biochemistry, \*Coalfish, \*Crude oil, \*Phenanthrene, \*Tissue analysis, \*Liver, \*Gall bladder

The distribution of radioactively-labelled phen-anthrene was studied at various time intervals fol-lowing intragastric injection. Samples of liver, gall lowing intragastric injection. Samples of liver, gall bladder and white muscle were analyzed from each fish. The liver showed by far the greatest degree of accumulation of radioactivity, Maximum accumulation occurred from 10 to 24 h after dosing and nearly 72% of the dose was present in this organ after 17 h. Large amounts of radioactivity were also found in the gall bladder and, not surprisingly, the highest values were recorded at somewhat later times (24-48 h). The gall bladder values remained fairly high until 96 h, a finding which is no doubt related to the fact that the fish were fasted until this time. The nature of the biliary and urinary metabolites in the present study will be dealt with in a subsequent publication. (Deal-EIS) (Deal-EIS) W80-00844

VARIABILITY OF THE CONCENTRATIONS OF SEVENTEEN TRACE ELEMENTS IN THE MUSCLE AND LIVER OF A SINGLE STRIPED BASS, MORONE SAXATILIS

Department of Energy, New York. Environmental Measurement Lab.

M. Heit.

Bulletin of Environmental Contamination and Toxicology, Vol 23, p 1-5, 1979. 1 Tab, 8 Ref.

Descriptors: \*Trace elements, \*Path of pollutants, \*Bass, \*Cadmium, \*Copper, \*Mercury, \*Nickel, \*Lead, \*Zinc, Heavy metals, Fish physiology, Chemical analysis, Spectrophotometry, \*Silver, \*Arsenic, \*Selenium, \*Tellurium, \*Tissue analysis.

During the study of a number of trace elements in striped bass it was noted that their distribution was striped bass it was noted that their distribution was not homogeneous. A comparison of the average element concentrations in the muscle with those found in both lobes of the liver indicated that the levels of Ag, As, Cd, Hg, Ni, Pb, Se, Te, and Zn were significantly higher (p < or = 0.10) in the liver than in the muscle. Only Cd, Hg and Se were significantly higher (p < or = 0.10) in concentration in the larger liver lobe as compared to the smaller lobe. These results are not unexpected in that a number of marine and freshwater species have been reported to have higher concentrations of trace elements in their liver than in their muscle tissue. (Deal-EIS) tissue. (Deal-EIS) W80-00846

DETERMINATION METHOD FOR RESIDUAL 1,3-DICHLORO-AND 1,3,5-TRICHLORO-2-(4-NITROPHENOXY) BENZENE (NIP AND CNP) IN FISH AND SHELLFISH,

Tokyo Metropolitan Research Lab. of Public Health (Japan).

T. Yamagishi, K. Akiyama, M. Morita, R. Takahashi, and T. Miyazaki.

Bulletin of Environmental Contamination and Toxicology, Vol 23, p 57-63, 1979. 3 Fig, 12 Ref.

Descriptors: \*Pesticide residues, \*Analaytical tech-Descriptors: Presticide residues, "Analaytical tech-niques, "Gas chromatography, Methodology, Chemical analysis, Chlorinated hydrocarbon pesti-cides, Pollutant identification, DDT, Polychlori-nated biphenyls, Chemical properties, Clams, Her-bicides, "Tissue analysis, "CNP, "NIP.

An electron capture gas chromatography technique is proposed for the detection of the pesticides NIP and CNP in fish and shellfish. This cides NIP and CNP in fish and shellfish. This method can remove other contaminating organ-colorine compounds such as PCBs and DDTs. The method involves homogenization of specimens, extraction by solvents, clean-up through saponification and chromatography on a Florisil column before gas chromatography. DDTs can be eliminated effectively by the saponification and PCBs by the Florisil chromatography. Results from fish and clam tissue were consistent in triplicated runs. Sensitivities of the method were 0.5 and 0.3 ppb for CNP and NIP, respectively. (Deal-EIS) EIS) W80-00847

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ORGANOCHLORINE RESIDUES IN EGGS OF THE ENDANGERED AMERICAN CROCO-DILE (CROCODYLUS ACUTUS), Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center. R. J. Hall, T. E. Kaiser, W. B. Robertson, Jr., and P. C. Patty. Bulletin of Environmental Contamination and Toxicology, Vol 23, p 87-90, 1979. 2 Tab, 6 Ref.

Descriptors: \*Pesticide residues, \*Reptiles, \*Chlorinated hydrocarbon pesticides, DDE, DDD, DDDT, Dieldtin, Heptachlor, Polychlorinated biphenyls, Chemical analysis, Pesticide kinetics, \*Chlordane, \*Nonachlor, \*Mirex, \*Tissue analysis, \*Bioaccumulation, \*Crocodiles, \*Toxaphene.

Eggs from eight clutches which failed to hatch were analysed for organochlorine residues. The eggs contained a variety of organochlorine contaminants. DDE, DDT, and PCBs were detected in all eight clutches. DDD, dieldrin, and metabolites of chlordane were each detected in seven clutches. Heptachlor epoxide was present at detectable levels in five clutches and mirex was found in four clutches. Endrin, toxaphene, and HCB were not detected. Mean residues were highest for DDE (1.2 ppm) and PCB (0.54 ppm) and were less than 0.1 ppm for all other contaminants. (Deal-EIS)

ABERRATIONS IN THE NEUROSECRETORY CELLS OF A FRESHWATER PULMONATE, INDOPLANORBIS EXUSTUS, CHRONICALLY EXPOSED TO SUBLETHAL CONCENTRATION OF TWO MOLLUSCICIDES, BACL2 AND CUSO4,

Marathwada Univ., Aurangabad (India). Dept. of Zoology.

M. M. Hanumante, R. Nagabhushanam, and D. P.

Vaidya.
Bulletin of Environmental Contamination and
Toxicology, Vol 23, p 70-72, 1979. 1 Tab, 14 Ref.

Descriptors: \*Pesticide toxicity, \*Snail, \*Cytological studies, Barium compounds, Copper sulfate, Toxicity, Animal physiology, Bioassay, Chemical properties, Chemical analysis, \*Tissue analysis, \*Histology.

Adults of Indoplanorbis exustus were exposed to concentrations of either 1.0 ppm BaCl2 or 0.1 ppm CuSO4 for seven days. Following exposure the central nervous systems of the snails were fixed and analysed. The CNS of I. exustus contains two types of NSC, A and B. Both the cells from cerebral, pleural, parietal and visceral ganglia revealed histopathological aberrations after 7 days of exposure. A significant (P. — 0.05) increases were exposure. A significant (P = 0.05) increase was evident in nuclear diameters of A and B cells without significant change in their cell dimensions. Both the molluscicides provoked striking declines in the neurosecretory material intensity from A and B cell perikarya. Their neurohaemal areas also showed depletion of neurosecretory material. Both the cell perikarya were laden with large number of vacuoles only after CuSO4 treatment. (Deal-EIS) W80-00849

FATE OF 14C-CIS-CHLORDANE IN GOLD-FISH, CARASSIUS AURATUS (L.), Illinois Univ. at the Medical Center, Chicago.

### Identification Of Pollutants-Group 5A

Dept. of Biological Sciences. M. Feroz, and M. A. Q. Khan. Bulletin of Environmental Contamination and Toxicology, Vol 23, p 64-69, 1979. 2 Fig, 1 Tab, 21

Descriptors: \*Radioactivity techniques, \*Pesticide kinetics, Tracers, Carbon radioisotopes, Radiochemical analysis, Pesticide residues, Fish physiology, Path of pollutants, Chlorinated hydrocarbon pesticides, Water chemistry, \*Chlordane, \*Tissue analysis, \*Bioaccumulation, \*Goldfish, \*Carassius.

Goldfish were exposed to 25.94 ppb radioactively labeled chlordane for 24-h and then maintained for 25 days. At the termination of the experiment the fish were analysed for radioactivity. It was found that over 99% of the radioactivity recovered from the fish was unchanged cis-chlordane, indicating its inert storage in body tissues. It was also observed that absorption of labeled chlordane was quite rapid, most occurring during the first 24-h. (Deal-ElS.) W80-00850

EFFECTS OF IN VIVO CADMIUM EXPOSURE ON ATPASSES IN GILL OF THE LOBSTER, HOMARUS AMERICANUS, National Marine Fisheries Service, Highlands, NJ. Sandy Hook Sport Fisheries Marine Lab. R. K. Tucker.

Bulletin of Environmental Contamination and Toxicology, Vol 23, p 33-35, 1979. 1 Tab, 10 Ref.

Descriptors: \*Cadmium, \*Lobsters, \*Toxicity, \*Enzymes, Chemical analysis, Path of pollutants, Inhibition, Biochemistry, Animal physiology, Heavy metals, Crabs, Crustaceans, \*Tissue analysis, \*Bioaccumulation.

sis, \*Bioaccumulation.

Gill homogenates from lobsters exposed to 6 ppb cadmium for 30 days showed an almost 25% increase in ouabain-insensitive ATPase activity. No difference in Na+K+ATPase, however, was apparent between control and cadmium-exposed animals. This latter enzyme is inhibited by ouabain and thus distinguishable in our assay system. Previous in vitro studies of ATPase activity in gill homogenates of the rock crab, C. irroratus, indicate that 10 ppm Cd when added to the assay incubation mixture, inhibited the Na+K+ATPase by almost 40% and also had a slight inhibitory effect on the remaining (ouabain-insensitive) ATPase activity. Although the in vitro cadmium concentration, 10 ppm, to which the rock crab eazymes were exposed, was much higher than the 6 ppb Cd in vivo expoşure for the lobsters, the tissue metal levels were much less disparate because of the ability of the living animals to take up metal. (Deal-EIS)

HEXACHLOROBENZENE (HCB) LEVELS IN LAKE ONTARIO SALMONIDS, Canada Centre for Inland Waters Burlington (On-

tario). A. J. Niimi.

Bulletin of Environmental Contamination & Toxicology, Vol 23, p 20-24, 1979. 1 Fig, 3 Tab, 17 Ref.

Descriptors: \*Pesticide residues, \*Salmonids, \*Lake Ontario, Pesticide kinetics, Chlorinated hydrocarbon pesticides, Path of pollutants, Persistence, Great lakes, Pollutant identification, Chemical analysis, Lake trout, Rainbow trout, Coho salmon, Lipids, \*HCB, \*Tissue analysis, \*Bioaccu-

This study examined the levels of HCB in lake trout, rainbow trout, and coho salmon from Lake Ontario to confirm the bioaccumulative property of this compound in a natural water body, and to evaluate its potential impact as an important environmental contaminant. HCB levels in whole fish homogenates averaged 80 nannogram/g for lake trout, 62 nannogram/g for rainbow trout, and 36 mannogram/g for coho salmon. The levels of HCB increased significantly with body weight for all species. For fish of the same weight, HCB levels were highest in lake trout, followed by rainbow trout, and coho salmon. Mean HCB levels in fat

were estimated to be 0.5 microg/g for lake trout, 0.7 microg/g for rainbow trout, and 0.5 microg/g for coho salmon. To put the significance of these levels into perspective, the United States Environmental Protection Agency has recommended an interim action guideline of 0.5 microg/g in the fat of domestic animals, and the Food and Drug Administration has adopted a guideline of 0.3 microg/g in the fat of mild and dairy products. (Deal-EIS) W80-00852

ALKANES IN BARNACLES (BALANUS TINTINNABULUM) FROM THE BUCCANEER OILFIELD,

Houston Univ., TX. Dept. of Biophysical Sciences. B. S. Middleditch, E. S. Chang, and B. Basile. Bulletin of Environmental Contamination & Toxicology, Vol 23, p 6-12, 1979. 1 Fig. 1 Tab, 12 Ref.

Descriptors: \*Aromatic compounds, \*Absorption, \*Oil, Crustaceans, Offshore platforms, Water chemistry, Chemical analysis, Animal physiology, Path of pollutants, Oil pollution, Texas, Gulf of Mexico, Buccaneer oilfield, \*Barnacles, \*Balanus, \*Tissue analysis, \*Bioaccumulation, \*Depuration.

The uptake and discharge of petroleum hydrocarbons by barnacles on offshore drilling platforms was studied. Results indicate that barnacles growing near the surface ingest oil-derived alkanes when the oil concentration in the water was relatively high. When the alkane concentration in the water is reduced, however, the ingested alkanes may be excreted. Shells from specimens collected both at the surface and below all contain petroleum-like alkanes although it is possible that such compounds derive from organisms attached to the leum-like alkanes although it is possible that such compounds derive from organisms attached to the shells. Further work is required to determine whether this assumption is correct. It is generally considered that petroleum hydrocarbons are not concentrated during passage through food webs. Since these compounds are present at higher concentrations in flesh from some barnacles than in the surrounding water, it would be of interest to determine the hydrocarbon content of fish which greater than the surrounding water. mine the hydrocarbon content of fish which graze on the barnacles. (Deal-EIS) W80-00853

PARATHION CAUSES SECONDARY POISON-ING IN A LAUGHING GULL BREEDING COLONY,
Fish and Wildlife Service, Victoria, TX. Gulf Coast Field Station.
D. H. White, K. A. King, C. A. Mitchell, E. F. Hill, and T. G. Lamont.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 281-284, 1979. 2 Fig, 8 Ref.

Descriptors: \*Pesticide toxicity, \*Gulls, \*Mortality, Growth stages, Organophosphorus pesticides, Mode of Action, Path of pollutants, Insects, Pesticide kinetics, Chemical analysis, \*Parathion, \*Tissue analysis, Texas, Nueces Bay.

In the spring of 1978, during the course of a study of the reproductive success of several aquatic bird species, 116 dead laughing gull chicks and dead adults were found. Shortly thereafter a second mass mortality of over 100 adults was discovered. Investigation revealed that a local cotton field had Investigation revealed that a local cotton field had recently been sprayed with parathion, an organophosphate pesticide. Analysis of stomach contents of dead gulls revealed the presence of large quantities of insects and between 0.02 and 10 ppm parathion. Brain tissue analysis demonstrated inhibited acetylcholinesterase activity, a sign of organophosphate pesticide toxicity. This is thought to be the first recordd instance of an organophosphate insecticide killing by means of insects carried to the young. (Deal-EIS) W80-00854

IN VITRO TOXICITY OF EIGHT MUTAGENS/ CARCINOGENS FOR THREE FISH CELL LINES,

Mashington Univ., Seattle. Dept. of Pathology. R. M. Kocan, M. L. Landolt, and K. M. Sabo. Bulletin of Environmental Contamination & Toxi-cology, Vol 23, p 269-274, 1979. 1 Fig. 11 Ref.

Descriptors: \*Toxicity, \*Chemical properties, \*Cytological studies, Organic compounds, Rainbow trout, Sunfishes, Fish physiology, Growth rates, Analytical techniques, Chemical analysis, Mode of action, \*Mutagens, \*Carcinogens.

action, \*Mutagens, \*Carcinogens.

Numerous techniques involving whole animal testing for cancer, cell culture for mutation and cytogenetic changes and bacterial mutagenicity have been devised to assay specific chemicals and inspect unknown mixtures. Little, however, has been done to determine the effects of foreign chemicals on aquatic organisms due to the difficulty of maintaining these animals in the laboratory. To circumvent some of these problems and still determine whether various chemical agents affect aquatic animals, we have explored the use of fish cell culture for initial screening. Established fibroblast cell lines from three species of fish were used for the toxicity studies, with human fibroblast cultures serving as positive controls. Eight known mutagens/carcinogens were analysed for toxic effects on the cell cultures. Two distinct responses to the mutagens were observed. In one, the number of cells continued to decline in direct proportion to the amount of chemical in the media. This represents increasing toxicity as the concentration of mutagen increases. The second response was one of an initial reduction in cell number below the controls but no further decrease in cell number as the mutagen concentrations increased. This response was the result of treated cells not dividing, while the untreated controls continued to replicate. (Deal-EIS) (Deal-EIS) W80-00855

OCCURRENCE OF PCB RESIDUES IN BURBOT (LOTA LOTA) AND LAKE TROUT (SALVELINUS NAMAYCUSH) FROM THE CHURCHILL FALLS POWER DEVELOPMENT AREA,
Department of Fisheries and Environment, Halifax

(Nova Scotia). C. J. Musial, J. F. Uthe, R. J. Wiseman, and R. A.

Matheson.

Bulletin of Environmental Contamination & Toxicology, Vol 23, p 256-261, 1979. 3 Fig. 1 Tab, 8

Descriptors: \*Polychlorinated biphenyls, \*Aro-clors, \*Lake trout, Chemical analysis, Gas chroma-tography, Path of pollutants, Water pollution sources, Powerplants, Water chemistry, Canada, Chemical wastes, Churchill Falls, \*Burbot, \*Tissue analysis, Hydroelectric power.

Fish taken above and below the Churchill Falls hydroelectric project (Canada) were analysed for PCB residues using the gas chromatography technique. The PCB patterns obtained from the fish taken at sampling sites upstream of the Churchill Falls generating station were most closely matched by mixtures of Aroclors 1254 and 1260 in ratios ranging from approximately 2:1 to 1:1 1254:1260. These results are consistent with the ratios of 1254 to 1260 found in marine fish such as cod from the offshore fishing grounds in the general area of the east coast of Canada. However, the pattern obtained from fish taken just below the Churchill Falls power plant (the 'tail race'), was most closely matched by Aroclor 1260 solely, with depression of certain penta-and hexachlorobiphenyl peaks and two of the octachlorobiphenyl peaks. This is interesting in view of the fact that 1254 is the principal mixture used in these hydroelectric power installations and may reflect an unusual degree of volatilization of the lower molecular weight components of Aroclor 1254 or an adsorption or other type of reaction which would result in removal or unavailability of these components for uptake by the fish. The total quantity of PCB being released into the river cannot be calculated at present because the levels in the water and sediments have not been determined. However, the high levels in the talls? W80-00856 EIS) W80-00856

TOTAL RESIDUAL CHLORINE: THE EFFECT OF SHORT-TERM EXPOSURE ON THE EM-

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### Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A-Identification Of Pollutants

ERALD SHINER NOTROPIS ATHERINOIDES

ERALD SHINER NOTROPIS ATHERINOIDES (RAFINESQUE), Minnesota Pollution Control Agency, Roseville. G. Fandrei, and H. L. Collins. Bulletin of Environmental Contamination and Toxicology, Vol. 23, p 262-268, 1979. 1 Fig, 1 Tab,

Descriptors: \*Chlorine, \*Toxicity, \*Shiners, Bloassay, Chlorination, Mortality, Fish physiology, Water temperature, Antifouling materials, Growth

The effects of short-term chlorine exposure, as occurs in antifouling operations associated with cooling systems, were studied at 10 and 25°C. Three cooling systems, were studied at 10 and 25C. Three age categories (adults, yearlings and young-of-the-year) were employed. Total residual chlorine (TRC) toxicity was significantly different at the two temperatures, the fish being approximately three times more sensitive at the higher temperature. The difference in sensitivity to TRC between the age groups was statistically insignificant, young-of-the-year being slightly more resistant. (Deal-EIS.) (Deal-EIS) W80-00857

TOXICITY AND TISSUE UPTAKE OF METH-YLMERCURY ADMINISTERED INTRAPERI-TONEALLY TO RAINBOW TROUT (SALMO GAIRDNERI RICHARDSON),

Alberta Univ., Edmonton. Dept. of Zoology. C. W. Hawryshyn, and W. C. Mackay. Bulletin of Environmental Contamination & Toxi-cology, Vol 23, p 79-86, 1979. 3 Fig. 1 Tab, 10 Ref.

Descriptors: "Mercury, "Absorption, "Rainbow trout, Fish physiology, Animal metabolism, Path of pollutants, Heavy metals, Toxicity, Mortality, Lethal limit, Organic compounds, "Methylmercury, "Tissue analysis, "Bioaccumulation.

The objective was to determine the 15 day LD50 for a single intraperitoneal dose of methylmercury (MMC) and secondly to measure the concentration (tissue uptake) of Hg in the brain, eye, and epaxial musculature 30 days following an injection of different sublethal doses of MMC. The 15 day LD50 ferent sublethal doses of MMC. The 15 day LD50 for a single intraperitional injection in rainbow trout is 5.7 plus or minus 0.4 mg Hg per kg of body weight, determined by interpolation. The mean uptake (body burden) for this was 5.1 plus or minus 0.6 microgram Hg per g of body tissue indicating that the fish accumulated approximately 90% of the dose administered. A one way analysis of variance indicated a significant difference between the mercury content of the three rissues or variance indicated a significant difference between the mercury content of the three tissues tested (brain > muscle > eye) (all P < 0.001) for each dose level. The concentration of mercury in each tissue increased significantly (P < 0.001) with increasing sublethal dose of methylmercury. (Deal-Electric Control of the property of the control of th EIS) W80-00859

POLYCHLORINATED BIPHENYLS IN PLANKTON FROM THE TURKU ARCHI-PELAGO.

urku, Univ. (Finland). Dept. of Chemistry and Biochemistry. R. R. Linko, P. Rantamaki, K. Rainio, and K.

Bulletin of Environmental Contamination & Toxicology, Vol 23, p 145-152, 1979. 1 Fig. 3 Tab, 17

Descriptors: \*Polychlorinated biphenyls, \*Plankton, Monitoring, Pollutant identification, Chemical wastes, Industrial wastes, Gas chromatography, Chemical analysis, Sampling, Lipids, Path of pollutants, \*Finland, \*Baltic Sea, Turku archipelago.

Plankton samples were collected during 1975-76 from the Turku archipelago (Finland). The samples were analysed for PCB content using gas chromatographic techniques. The 1974 samples contained an average of 38 ppm lipid weight or 0.37 ppm wet weight PCBs. The 1975-76 sample averages were 28 and 0.23 ppm, respectively. A large variation in PCB content was noted according to sample location and season. (Deal-EIS) W80-00861

TUMOURS AND MICROBIAL DISEASES OF MARINE FISHES IN ALASKAN WATERS, National Marine Fisheries Service, Seattle, WA. Environmental Conservation Div. B. B. McCain, W. D. Gronlund, M. S. Myers, and

S. R. Wellings.

Journal of Fish Diseases, Vol 2, p 111-130, 1979. 15 Fig. 1 Tab. 15 Ref.

Descriptors: \*Fish diseases, \*Demersal fish, \*Alaska, Animal pathology, Fish populations, Pathogenic bacteria, Pseudomonas, Infection, Size, Length, Sampling, Oil, Oil spills, \*Neoplasms, \*Tissue analysis.

\*Tissue analysis.

In an effort to further define the current health status of demersal fish in the Bering Sea, 36,618 fish captured by otter trawl during 1976 were examined for pathological conditions. Of the 26 species examined, 22 were found to have no detectable abnormalities. The four species with abnormalities were Pacific Cod Gadus macrocephalus Tilesius with pseudobranchial tumours and skin lesions, walleye pollock Theragra chalcogramma (Pallas) with lymphocystis, and rock sole Lepidopaetta bilineata (Ayres) with epidermal papillomas. The prevalence, geographical distribution and biological and pathological characteristics of affected individuals were determined. Two main types of skin lesions were seen on Pacific cod: ulcers and ring-shaped lesions. Isolates of bacteria (Pseudonnas sp.) were routinely obtained from the coducers and may be the cause of this disease. The ring-shaped skin lesions, when examined microscopically, contained unidentified epidermal basophilic bodies. The study was conducted to evaluate the impact of oil exploration and production. (Deal-EIS)

EFFECTS OF TERRITORIALITY ON OXYGEN CONSUMPTION IN TILAPIA NILOTICA, Hokkaido Univ., Hakodate (Japan). Faculty of

S. Y. Mishrigi, and T. Kubo.
Bulletin of the Faculty of Fisheries of Hokkaido
University, Vol 29, No 4, p 308-312, 1978. 2 Tab,
14 Ref.

Descriptors: \*Fish behavior, \*Tilapia, \*Oxygen requirements, Fish physiology, Animal metabolism, Oxygen, Water chemistry, Growth rates, Weight, Growth stages, Size, \*Territorial behavior.

The agressive behaviour associated with territoria-The agressive benaviour associated with territoria-lity in Tilapia nilotica was found to elevate the oxygen consumed to meet routine metabolism energy requirements at 26C. This was traced for both small immature and large adult fish. On the other hand mature fish showed a decrease of about 50% in the oxygen consumed for specific dynamic action. This suggests an increase in the weight exponent and a decrease of the level of metabolism of the T-line equation. Also, there is a correlation between the available space to meet the territory requirements and hence the magnitude of the ag-gressive behaviour, and runting of tilapia under culture condition. (Deal-EIS) W80-00863

SEPARATE AND JOINT TOXICITY TO RAINBOW TROUT OF SUBSTANCES USED IN DRILLING FLUIDS FOR OIL EXPLORATION, Guelph, Univ. (Ontario). Dept. of Zoology. J. B. Sprague, and W. J. Logan. Environmental Pollution, Vol 19, p 269-281, 1979. 2 Fig. 2 Tab. 27 Ref.

Descriptors: \*Toxicity, \*Rainbow trout, \*Surfactants, \*Drilling fluids, Chemical properties, Chemical wastes, Fish physiology, Mortality, Lethal limit, Sorption, Bioassay, Alcohols, Organic compounds, Paraformaldehyde, Capryl alcohol, Benticolis Bacife. tonite, Barite.

Paraformaldehyde, capryl alcohol, and 5 surfac-tants were lethal to rainbow trout at less than 100 mg/litre. They were the most toxic of 21 tested materials likely to be present in used well-drilling fluids. Least toxic were bentonite, barite, and several organics. There was no consistent picture for

joint action in mixtures. Used fluids were lethal at 0.71, 1.2 and 0.83 times the values predicted from an assumption of additivite toxicity of approximated components. Those results were in statistical agreement with additivity. The LC50 of the simulated fluid was 1.5 times the value predicted from its seven components, significantly less-than-additive. When the seven most toxic components were added singly to simulated fluid, about half the results were not different from additive joint action. However, for every component plus fluid, there was antagonism in at least one of three proportions tested. Strongest antagonism was 3.7 times the predicted value for the surfactant B-Free added to fluid. Decreased toxicity may have resulted from sorption of components on bentonite, or different toxic mechanisms for fish. Six of the seven most toxic components lost toxicity upon ageing for 16 days in water, while B-Free increased sharply in toxicity. (Deal-EIS)

INFLUENCE OF SALINITY AND CADMIUM ON CAPSULE STRENGTH IN PACIFIC HER-RING EGGS, Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station. D. F. Alderdice, H. Rosenthal, and F. P. J. Velsen. Helgolander wissenschaftlichen Meeresuntersuntersuchungen, Vol 32, p 149-162, 1979. 5 Fig, 1 Tab, 30 Ref.

Descriptors: \*Cadmium, \*Salinity, \*Fish eggs, \*Herrings, Toxicity, Fish reproduction, Fish physiology, Water chemistry, Calcium, Size, Growth rates, Mechanical properties, Strength.

Eggs of Pacific herring (Clupea pallasi) were incubated at 5C in salinities of 5, 20, and 35 ppt, and in cadmium concentrations of 0.05, 0.1, 1, 5, and 10 ppm (20 ppt S). Bursting pressures of eggs in the eight groups were measured throughout incubation. In general, bursting pressures rose to a primary maximum after fertilization, declined, rose to a tion. In general, bursting pressures rose to a primary maximum after fertilization, declined, rose to a secondary maximum, then declined again toward hatching. Rate of attainment of the primary maximum was related to salinity of the incubation medium. Bursting pressures at the primary and secondary maxima reached final values of about 1300 and 700 g, respectively, in incubation salinities at and above 20 ppt. Corresponding egg volumes were greatest in low salinities (5 ppt) and near minimum values in salinities of 20 ppt or greater (35 ppt). Cadmium in the incubation medium delayed attainment of primary maximum bursting pressures and primary and secondary maxima were reduced to 200-350 g at Cd concentrations near 1 ppm. Egg volumes also decreased with increased Cd concentration. It appears that Ca++/Cd++ ratios, depending on salinity and Cd levels in the incubation medium, influence the properties of both the jelly coat and the capsule of herring eggs. Changes in the properties of these layers could make the eggs more susceptible to mechanical damage, particularly at combinations of higher (approx or > 1 ppm) Cd concentration and lower (approx or < 20 ppt) salinities. (Deal-EIS) EIS) W80-00865

INFLUENCE OF SALINITY AND CADMIUM ON THE VOLUME OF PACIFIC HERRING

EGGS, Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station. D. F. Alderdice, H. Rosenthal, and F. P. J. Velsen. Helgolander wissenschaftlichen Meeresuntersuchungen, Vol 32, p 163-178, 1979. 5 Fig, 3 Tab, 35 Ref.

Descriptors: \*Salinity, \*Cadmium, \*Toxicity, \*Fish eggs, Growth stages, Volume, Water chemistry, Osmosis, Ion exchange, Biological membranes, Fish physiology, Fish reproduction, Fertilization, Herring, \*Tissue analysis.

Changes in total volume and volume of the yolk and perivitelline space of Pacific herring eggs were examined throughout incubation at SC in relation to salinity of the incubation medium (5, 20, 35 ppt S), and after exposure to cadmium (0.05-10 ppm

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Identification Of Pollutants-Group 5A

Cd) at 20 ppt S. After fertilization and filling of the perivitelline space there was a decline in total egg volume in all salinities until 60-80 hr after fertilization. There followed a period of relative stability of total volume (100-240 hr), then a slow decline until hatching (240-619 hr). There was an inverse relation between egg volume and salinity at all stages of egg development. Prior to 80 hr, changes in egg volume appeared primarily to be simple diustments to prevailing composition and ionic condiin egg volume appeared primarily to be simple adjustments to prevailing osmotic and ionic conditions, modified, however, by presumed irreversible changes induced in the egg in relation to salinity experience at, and shortly after, fertilization. Subsequently, between 80-100 hr, egg volume appears to become regulated, commencing in the interval between late blastodermal overgrowth and blastopore closure. (Deal-EIS) W80-00866

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\*Toxicity, ater chemical mem-

f the yolk eggs were in relation 20, 35 ppt 05-10 ppm DDT AND ITS METABOLITES IN ANTARCTIC BIRDS, Warsaw Univ. (Poland). Dept. of Zoology and

Ecology.
A. B. Lukowski. Polskie Archiwum Hydrobiologii, Vol 25, No 3, p 729-737, 1978. 1 Fig, 3 Tab, 13 Ref.

Descriptors: \*DDT, \*Path of pollutants, \*Birds, \*Pesticide residues, DDD, DDE, Chlorinated hydrocarbon pesticides, Insecticides, Gas chromatography, Chemical analysis, Food chains, Antarctic, Animal physiology, Food habits, \*Tissue analysis, \*Bioaccumulation, \*Liver.

Contents of pp'DDE, pp'DDD and pp'DDT in the liver, muscle and adipose tissue of nine species of Antarctic birds were determined by gas chromatography. These birds originated from the regions of: Palmer Archipelago, Kinge Island and South Georgia Island, in February and March 1976. The tissue content of total DDT was highest in Catharacta skus from the Palmer Archipelago region. Maximum content of insecticides in the liver, muscle and adipose tissue was 1.5649, 1.5730 and 6.5916 ppm, respectively. Differences in the tissue contents of pp'DDT and its metabolites between birds of different species are most likely due to the dissimilarities in their food ration. (Deal-EIS)

DDT AND ITS METABOLITES IN ANTARCTIC KRILL (EUPHAUSIA SUPERBA DANA) FROM SOUTH ATLANTIC, Warsaw Univ. (Poland). Dept. of Zoology and

Ecology. A. B. Lukowski.

Polskie Archiwum Hydrobiologii, Vol 25, No 3, p 663-668, 1978. 1 Fig. 1 Tab, 8 Ref.

Descriptors: \*Pesticide residues, \*DDT, \*Path of pollutants, \*Invertebrates, DDD, DDE, Antarctic, Gas chromatography, Chemical analysis, Chlorinated hydrocarbon, Pesticides, Insecticides, Food chains, \*Krill, \*Euphausia.

pp'DDE, pp'DDD and pp'DDT contents in bodies of krill from Antarctic waters of South Atlantic were determined by gas chromatography. Samples were taken in February and March 1976 in the following regions: Drake Passage, Bransfield Strait, South Georgia and South Sandwich Islands; the mean contents of total DDT were 0.0645, 0.0231, 0.0045 and 0.0040 ppm, respectively. Differences in the content and qualitative composition of total DDT between the samples from the different regions were considered from the standpoint of the dissimilarities in the age structure of the poouent regions were considered from the standpoint of the dissimilarities in the age structure of the popu-lations, and from the angle of the presumably higher local contamination with insecticide resi-dues in the Drake Passage and Bransfield Strait regions. (Deal-EIS) W80-0066

APPARATUS AND METHOD FOR THE DISCOVERY OF VOLATILE ORGANIC COMPOUNDS IN WATER,

Petro-Tex Chemical Corp., Houston, TX. (Assign-

G. E. Button, J. R. Burke, and C. E. Dowden. U.S. Patent No 4,154,086, 4 p. 1 Fig. 5 Ref; Official

Gazette of the United States Patent Office, Vol 982, No 3, p 831, May 15, 1979.

Descriptors: \*Patents, \*Water sampling, \*Organic compounds, Water pollution sources, Separation techniques, Volatile organic compounds.

techniques, Volatile organic compounds.

The invention is an apparatus for discovering trace amounts of volatile organic compounds in water comprising a column having a lower zone containing a heating means, a sample water outlet and a carrier gas inlet; and intermediate zone containing a condenser and sample water inlet—the sample water inlet being positioned below the condenser; and an upper zone having a gas detection means. The carrier gas inlet is located at the bottom of the lower zone or at some other point provided that the location of the carrier gas intel is below the sample water outlet. The passage of the carrier gas through the water aids in stripping out volatile organic compounds. The carrier gas may be air, when the detection means operates by burning of the volatile organic compounds or it may be an inert gas if a chromatography column is used in the detection process. In the intermediate zone, the condenser is operated to condense any water vapor and return it to the lower zone of the column but not any volatilized organic compounds. There are and return it to the lower zone of the column but not any volatilized organic compounds. There are baffles located below the water inlet to provide contact surfaces which will become heated by the passage of the carrier gas from the heated portion of the column, where some of the lower boiling organic compounds will vaporize. The volatile organic compounds are those having boiling points below that of water under the conditions of pressure in the column. (Sinha-OEIS)

THE LIMNOLOGICAL RESPONSE OF A WEST VIRGINIA MULTIPURPOSE IM-POUNDMENT TO ACID INFLOWS, Army Engineer District, Pittsburgh, PA. For primary bibliographic entry see Field 5B. W80-00954

CHEMICAL AND PHYSICAL PROCESSES CONTROLLING THE CHEMICAL COMPOSITION OF SUSPENDED MATERIAL IN THE RIVER TAY ESTUARY, Edinburgh Univ. (Scotland). Grant Inst., of Geolo-

For primary bibliographic entry see Field 2L. W80-00960

SUSPENDED SEDIMENT SOURCES IDENTI-FIED BY MAGNETIC MEASUREMENTS, Exeter Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 2J. W80-00964

THE EFFECTS OF URBANIZATION ON GROUND-WATER QUALITY--A CASE STUDY, Wisconsin Univ. -Madison. Dept. of Geology and Geophysics. For primary bibliographic entry see Field 5B. W80-00965

PREVALENCE OF ENTEROVIRUSES IN GROUND WATER OF ISRAEL, Ministry of Health, Tel Aviv (Israel). Central Virus Lab.

Y. Marzouk, S. M. Goyal, and C. P. Gerba. Ground Water, Vol 17, No 5, p 487-491, September-October 1979. 5 Tab, 32 Ref.

Descriptors: \*Groundwater, \*Viruses, \*Bacteria, \*Indicators, Sampling, Laboratory tests, Coliforms, Streptococcus, Correlation analysis, Pollutants, Path of pollutants, Water pollution, Water quality, Enteroviruses.

Few studies have been performed on the occur-rence of enterovirus contamination of ground-water. In this study, 99 groundwater samples were examined for the presence of enteroviruses, total bacteria, fecal coliforms, and fecal streptococci by standard methods. Enteroviruses were isolated from 20% of the samples. Viruses were isolated from 12 samples which contained no detectable fecal organisms per 100 ml. No statistical correlation between presence of virus and bacteriological indicators could be determined. The widespread failure of current bacteriological standards to indicate the presence of potentially pathogenic enteroviruses in groundwater is an area of concern that requires more study. (Sims-ISWS) W80-00966

TEMPORAL VARIATION IN THE NUTRIENT EXPORT OF RIVERS DRAINING INTO THE BAY OF QUINTE, ONTARIO, CANADA, Canada Centre for Inland Waters, Burlington (On-

For primary bibliographic entry see Field 5B. W80-00968

IN SITU FREEZING AS A CAUSE OF MORTALITY IN BROWN TROUT EGGS, Wyoming Univ., Laramie. Water Resources Research Inst.
D. W. Reiser, and T. A. Wesche.
The Progressive Fish Culturist, Vol 41, No 2, p 58-60, 1979. 1 Fig, 2 Tab, 16 Ref.

Descriptors: \*Fish eggs, \*Mortality, \*Cold Resistance, \*Redds, Water temperature, Brown trout, Aquiculture, Seasonal, Spawning, Habitats, Fish reproduction, Flow, Water properties, Freezing, Water temperature, Loramie River, Wyoming.

In November 1975, 60 Vibert boxes, each containing 100 green eggs of brown trout (Salmo trutta), were placed in artificial redds in the Laramie River were placed in artificial redds in the Laramie River in southeastern Wyoming. Water depths and velocities were measured, and a representative substrate sample was collected at each site. Because of extensive ice cover in March 1976, only 20 of the 60 boxes of eggs were recovered. Survival of eggs in these boxes was low (average, less than 1%), and only 10 of the 20 boxes contained live eggs (survival range, 0.5 to 3.4%; average, 1.95%). Three boxes were completely frozen, even though they were buried 15 cm in the substrate and covered with 12 to 20 cm of flowing water. Eleven of the 20 redds, including two of the frozen sites, fell within established spawning criteria for brown trout (water depth, 9 cm or more; water velocity, 15-46 cm/s). No correlation was demonstrated between water depth and survival (r=0.51) or between water depth and survival results and resu tween water depth and survival (r=0.51) or between water velocity and survival (r=0.21). Extremely low water temperature and in situ freezing of redds were the two main factors contributing to the high egg mortality. Freezing of redds may occur even in a suitable spawning environment. (Deal-EIS)

SOURCE ASSESSMENT: RECLAIMING OF WASTE SOLVENTS, STATE OF THE ART, Monsanto Research Corp., Dayton, OH. D. R. Tierney, and T. W. Hughes. Report EPA-600/2-78-004f, April 1978, 53 p, 13 Fig. 18 Tab, 45 Ref, 2 Append. 68-02-1874.

Descriptors: \*Air pollution, \*Solvents, \*Industrial Descriptors: "Air pollution, "Solvents, "Industrial wastes, "Organic compounds, "Solvent reclamation, Water pollution sources, Industrial plants, Industrial production, Water pollution control, Water quality, Water quality standards, Industries, Pollutant identification.

The composition, quantity, and rate of air emissions from processes and facilities for waste solvent reclamation are reviewed. With a five percent annual increase in solvent reclamation, the total increase in 1977-1980 hydrocarbon emissions from these processes is about .03 percent or 59 metric tons. Described are: (1) processes, materials, and geographical distribution of solvent reprocessing; (2) emissions, including selected pollutants, emission factors, environmental effects, and definition of a hypothetical but statistically typical reclamation plant; (3) present status and expected future developments in control technology; (4) growth and nature of the solvents reclamation industry, including present and emerging technology and industry production trends. The plant is hypothesized in order to determine typical source sever-

### Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A-Identification Of Pollutants

ity. Population density for the plant is determined from data on locations of 30 private contractors sites selected at random and representing 19 states. Plant parameters include production capacity, population density and emission heights. Source severity is treated as maximum ground level concentrations divided by a hazard factor. Ground level concentration is derived by Gaussian plume methodology and ambient air quality standards represent hazard factors for criteria pollutants. (Harris-Wisconsin) Wisconsin)

SEDIMENT OXYGEN DEMAND IN A SHALLOW OXBOW LAKE.

Illinois State Water Survey, Urbana.

Ininois State Water Survey, Oroana.

7. A. Butts, and R. L. Evans.

Available from the National Technical Information

Service, Springfield, VA 22161 as PB80-110414,

Price codes: A03 in paper copy, A01 in microfiche.

ISWS Circular 136, 1979. 28 p, 4 Fig, 11 Tab, 20

Ref, 3 Append.

Descriptors: \*Sediments, \*Oxbow lakes, \*Oxygen demand, \*Illinois, On-site investigations, Data collections, Methodology, Analysis, Analytical techniques, Sampling, Instrumentation, On-site tests, Dissolved oxygen, Water quality, \*Horseshoe lake(IL), Sediment oxygen demand.

In-situ sediment oxygen demand (SOD) measurements were made during the summer-fall of 1978 in HorseshoeLake (in the Mississippi River flood HorseshoeLake (in the Mississippi River flood plain) in conjunction with a water quality sampling program. This report presented only the findings of the SOD investigation. Sediments throughout Horseshoe Lake exert a significant oxygen demand on the overlying water, with the highest demands in dead zones of the lake. The sediments on the basis of SOD rates alone can be classed as moderated by the sediments of t ately polluted. Bacteria and other microorganisms are the principal cause of the demand; macroinverare the principal cause of the demand; macroinvertebrates cause about 1% or less. The primary productivity of the lake is very high, and algal fallout may be a significant contributor to SOD. Dissolved oxygen in the lake is rapidly depleted in the absence of surface aeration or photosynthetic oxygen production. A simple mathematical model developed and verified to predict DO concentrations under warm, quiescent, dark conditions indicated that only about 36 hours would be needed to totally deplete DO under these conditions. The information generated by this study provides a good base from which to evaluate the degraded conditions of the sediments and the effects of these sediments on the oxygen resources of the lake. sediments on the oxygen resources of the lake. (Humphreys-ISWS) W80-01010

REMOVAL OF 'SOLUBLE' IRON IN THE PO-TOMAC RIVER ESTUARY,

Johns Hopkins Univ., Baltimore, MD. Chesapeake

A. Eaton. Estuarine and Coastal Marine Science, Vol 9, No 1, p 41-49, July 1979. 4 Fig, 1 Tab, 15 Ref, 1

Descriptors: \*Estuaries, \*Iron, \*Potomac River, \*Chesapeake Bay, Geochemistry, Chemicals, Sampling, Saline water-freshwater interfaces, Bacteria, Coagulation, Filters, Filtration, Chemistry analysis, Water quality, Heavy metals, Colloids, Pollutants, Path of pollutants, Geochemical cycle.

'Soluble' iron levels in the Potomac River estuary are extremely low, usually less than 0.5 micro-M at mile 90 (freshwater) and decrease downstream to less than 0.05 micro-M prior to the intrusion of salt water. Removal of 'soluble' and fine filterable iron in the freshwater obeys first order kinetics with a rate constant of about 0.1/day. Addition of bacteriocides to samples stabilizes iron concentrations, suggesting that in this estuary freshwater colloids are destabilized by bacterial polymers. The extensive removal of iron in freshwaters is a different phenomenon from the salinity-dependent removal observed by several other workers in different estuaries. (Sims-ISWS) W80-01014

SURVEY OF SOME CANADIAN LAKES FOR THE PRESENCE OF ULTRASTRUCTURALLY DISCRETE PARTICLES IN THE COLLOIDAL National Water Research Inst., Burlington (Ontar-

Journal of the Fisheries Research Board of Canada, Vol 36, No 8, p 906-921, August 1979. 17 Fig, 1 Tab, 9 Ref.

Descriptors: \*Lakes, \*Canada, \*Colloids, \*Sus-pended solids, Surveys, On-site investigations, Clays, Sediments, Particle size, Particle shape, Limnology, Water sampling, Methodology, Labo-ratory tests, On-site data collections, Analysis, Analytical techniques, Electron microscopy, Foreign research, \*Fibrils

Water samples from 9 Canadian lakes were centrifuged, and the pellets were analyzed by transmission electron microscopy. The pellets included
small organisms, organic colloids, and clay particles. In almost all the samples, colloids were the
major component revealed following thin-section
analysis. When viewed at high magnification,
much of each pellet consisted of morphologically
discrete particles, some of which were readily categorized. Electron-opaque fibrils of colloidal size
were frequently encountered (1) at different
depths, (2) as a coating on the surface of algae and
bacteria, (3) overlaying the sediments, (4) as an
apparent adhesive between a variety of particles,
and (5) as a component of froth at the water-air
interface. They were common at all times and in Water samples from 9 Canadian lakes were centriinterface. They were common at all times and in lakes of various trophic levels and sizes. (Humphreys-ISWS) W80-01037

FINE PARTICULATE ORGANIC CARBON OUTPUT FROM FENS AND ITS EFFECT ON BENTHIC MACROINVERTEBRATES,

California Univ., Berkeley. Dept. of Forestry and Conservation.

D. C. Erman, and W. C. Chouteau. Oikos, Vol 32, No 3, p 409-415, 1979. 6 Fig, 1 Tab, 29 Ref.

Descriptors: \*Toxicity, \*Benthic fauna, \*Fen, Benthos, Suspended solids, Carbon, Organic com-pounds, Streams, Aquatic insects, Dominant organ-isms, Invertebrates, Seasonal, Sagehen Creek, California, Productivity,

Fine particulate organic carbon (FPOC) output was sampled from three fens in the Sagehen Creek basin in the Sierra Nevada mountains to establish any seasonal or daily trends in output. Stream invertebrates were sampled to determine if they were more abundant below fen outlets to Sagehen Creek. We found the fens released large quantities of FPOC annually (5 to 20 g/sq m/yr) with the greatest concentrations from all fens combined occurring in summer (2 mg/1). Large fluctuations in output occurred in summer; lowest concentration was in afternoon coincident with high stream temperature and low discharge. Filter feeding black-flies in Sagehen Creek were significantly more abundant below fen outlets than above, but other benthic macroinvertebrates showed no response. (Deal-EIS) W80-01045

EFFECTS OF A THERMAL DISCHARGE ON REPRODUCTIVE CYCLES IN MYTILUS EDULIS AND MYTILUS CALIFORNIANUS (MOLLUSCA, BIVALVIA),

California Univ., Berkeley. Dept. of Zoology.

A. H. Hines.
Fishery Bulletin, Vol 77, No 2, p 498-503, 1979. 5
Fig, 19 Ref.

Descriptors: \*Thermal stress, \*Toxicity, \*Mussels, Water temperature, Thermal powerplants, Cooling waters, Reproduction, Animal physiology, Seasonal, Cycles, Biorhythms, Size, Energy budget, Morro Bay, Calif., Mytilus.

This study examined the effect of a thermal discharge from a coastal steam-electric power plant on reproduction in M. edulis and M. californianus

in central California. The reproductive cycles and gonadal weights of these mussels in the warm water outfall and in control regions of naturally water outfall and in control regions of naturally occurring temperatures were compared using body component index methods. Water temperatures in the outfall exceeded 20C much of the late summer and early fall, while plant intake temperatures were usually in the 12-15C range and rarely exceeded 17C. The gonadal indexes of M. edulis from the outfall and from the control populations showed the same distinct cycle of gonads increasshowed the same distinct cycle of gonads increas-ing in size during summer and fall and dropping to a low in spring. However, gonadal weights of the outfall population were lower than the controls, as outnat population were lower than the controls, as can be seen by the generally lower level of the outfall gonadal index. In contrast to M. edulis, the gonadal index of M. californianus did not show a distinct annual cycle. Contrary to the trend shown by gonadal index levels, outfall body weight/shell volume indexes were consistently lower than the controls, indicating that the control mussels were in better nutritional conditions. (Deal-EIS) W80-01046

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AN APPARATUS FOR STUDYING THE EFFECT OF PH AND CO2 ON FISH EM-

BRYOS, Akademiya Nauk URSR, Kiel. Inst. Hidrobiologii. V. P. Bil'ko.

Hydrobiological Journal, Vol 13, No 4, p 110-114, 1977. 2 Fig, 1 Tab, 28 Ref.

Descriptors: \*Research equipment, \*Carbon dioxide, \*Hydrogen ion concentration, Laboratory equipment, Electrical equipment, Monitoring, Bioassay, Laboratory tests, Aquaria, Embryonic growth stage, Water chemistry, Fresh water fish, Methodology.

An analysis of existing techniques for maintaining a present pH and CO2 level in experiments with fish is given. The major drawbacks of these methods are discussed and an apparatus designed to eliminate these flaws is described. The main elements of the apparatus are electronic instruments: a pH meter and automatic titrimeter. The main drawback of our apparatus is its complexity. (Deal-EIS) W80-01047

CONCENTRATIONS IN JUVENILE

FLATFISH, Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Lab. N. J. Milner.

Journal of the Marine Biological Association of the United Kingdom, Vol 59, p 761-775, 1979. 5 Fig, 7 Tab, 44 Ref.

Descriptors: \*Zinc. \*Marine fish. \*Juvenile growth stage, Sediments, Shrimp, Weight, Growth stages, Regression analysis, Seasonal, Path of pollutants, Metals, Fish physiology, Animal metabolism, Chemical analysis, Water chemistry, Wales, England, Humber Estuary, \*Plaice, \*Tissue analysis, Bioaccumulation.

Zinc concentrations were measured in sediments, shrimps and the juveniles of four species of flatfish from beaches in South Wales and the Humber Estuary. Body weight (W) was the major source of variability in flatfish zinc concentration (Mc). Reression analysis removes this source of variation gression analysis removes this source of variation and the slope (Kc) and intercept (In a) of the equation In Mc = In a + Kc In W were used to investigate inter-and intra-specific variation. Slopes investigate inter-aim intra-specific variation. Stopps of the regressions were found to be species-specific, and interspecific variations in zinc levels were demonstrated by the intercepts, which showed seasonal variation in plaice. At any one time zinc concentration in O-group plaice was inversely related to body weight, and over the first 2 years of the property life concentrations also decreased with growth; but seasonal fluctuations impinged on this decrease to cause an increase during the first winter. No geo-graphical variation was observed that correlated with sediment or shrimp zinc levels. Reasons for the weight-specific nature and the seasonal variation of zinc concentrations are discussed. (Deal-W80-01048

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Identification Of Pollutants—Group 5A

CELL-FREE BENZO(A)PYRENE HYDROXY-LASE ACTIVITY IN MARINE ZOOPLANK-

Kent Univ., Canterbury (England). Biological La J. M. Walters, R. B. Cain, I. J. Higgins, and E. D. S. Corner.

Journal of the Marine Biological Association of the United Kingdom, Vol 59, p 553-563, 1979. 3 Fig, 4 Tab, 25 Ref.

Descriptors: \*Enzymes, \*Zooplankton, \*Organic compounds, Oil, Metabolism, Biodegradation, Co-pepods, Biochemistry, Crab, Chemical analysis, Regression analysis, Invertebrates, Polyaromatic hydrocarbons, Benzo(a) pyrene.

Samples of mixed zooplankton, mixed microplankton and two individual species of calanoid copepod were assayed for benzo(a)pyrene hydroxylase (aryl hydrocarbon hydroxylase) as part of an investigation to determine the contribution of zooplankton to the metabolism of hydrocarbons in the sea. Cell-free preparations from all the plankton samples tested contained benzo(a)pyrene hydroxylase activity. In addition, exposure of Calanus to various hydrocarbons at concentrations ranging from 50 to 200 microg/1 caused increased activity of the enzyme, in some instances that of treated animals being more than twice that of untreated controls. (Deal-EIS)
W80-01049

NITROGEN GAS SUPERSATURATION DURING ARTIFICIAL AERATION AT LAKE CASITAS, CALIFORNIA, Limnological Associates, Kaneohe, HI. A. W. Fast.

A. W. Fast. The Progressive Fish Culturist, Vol 21, No 3, p 153-155, 1979. 1 Fig, 7 Ref.

Descriptors: \*Water chemistry, \*Nitrogen, \*Aeration, Lake Casitas, California, Oxygen, Water temperature, Reservoirs, Gases, Supersaturation, Zone of saturation, Fishkills, Dissolved bases, Lake

Artificial aeration of lakes by compressed air injection is a potential source of nitrogen gas supersaturation. Artificial destratification by aeration (that is, thermal destratification through the mixing of bottom waters with surface waters by air injection to the process the activation is made to the contraction of the process that the process is a contraction of the process obtiom waters with surface waters by air injection near the bottom) is such a possible source of gas supersaturation. This possibility was investigated in an artificial impoundment that has been artificially aerated since 1968. Nitrogen gas was measured with a tensionmeter. Results showed that artificial destratification by air injection can cause excessive ossignment of the major risk is that if bottom waters were released from the reservoir, massive fish mortalities could result downstream. (Deal-EIS) W80-01050

LONG-TERM RESIDUAL EFFECTS OF PO-LYETHYLENEIMINE ON DAPHNIA, Moscow State Univ. (USSR). N. S. Stroganov, N. N. Maksimova, and Isakova

Hydrobiological Journal, Vol 13, No 3, p 74-82, 1977. 5 Fig. 3 Tab, 13 Ref.

Descriptors: \*Daphnia, \*Toxicity, \*Organic compounds, Mortality, Genetics, Animal physiology, Reproduction, Fecundity, Animal behavior, Growth rates, Size, Length, \*Polyethyleneimine, Mutagens.

Polyethyleneimine exerts a multifaceted effect on Daphnia magna Straus. At concentrations of 0.1 mg/liter, it caused negligible deviations from the control. At concentrations of over 1 mg/liter, the control. At concentrations of over 1 mg/iter, the preparation was highly toxic. In 1 mg/iter solu-tion Daphnia lived for seven generations and re-produced, but mortality increased, the rate of sexual maturation changed, as did fecundity and moulting. From the second generation on, dwarf forms appeared, the numbers of which increased, torms appeared, the numbers of which increased, reaching 100 percent in the fourth generation. The body size of the cladocerans decreased by an average of factor 2.3 in the six generations. When the Daphnia were transferred to pure water, the

dwarfs persisted in all subsequent generations. The mechanism of the inherited changes is discussed. (Deal-EIS) W80-01051

THE EFFECTS OF MACROPHYTES ON HYDROCHEMISTRY OF THE SHALLOWS OF THE KREMENCHUG RESERVOIR,

Akademiya Nauk URSR, Kiev. Inst. Hidrobiolo-

A. I. Merezhko, A. K. Ryabov, and G. V.

Hydrobiological Journal, Vol 13, No 3, p 97-100, 1977. 3 Tab, 9 Ref.

Descriptors: \*Water chemistry, \*Aquatic plants, \*Reservoirs, Hydrogen ion concentration, Oxygen, Calcium, Photosynthesis, Trace elements, Estu-aries, Seasonal, Dissolved oxygen, USSR, Kre-monchug Reservoir, Water quality, Iron, Copper, Zinc, Manganese.

Data are presented on the effects of higher aquatic plants on chemistry of shallow waters of this reservoir. It is shown that the change in the pH is determined by the photosynthetic activity of the plants. A correlation was established between calcium ion content and photosynthesis by the plants.

A positive effect by the plants on the oxygen content of the shallow waters is noted. (Deal-EIS)

AN OPTICAL METHOD FOR RECORDING CARDIAC RHYTHM IN DAPHNIA, Vsesoyuznyi Nauchno-Issledovatelskii Inst. Tsel-lyulozno-Bumazhnoi Promyshlennosti, Leningrad (USSR).

B. I. Kolupayev, A. A. Andreyev, and Yu. K. Samoylenko. Hydrobiological Journal, Vol 13, No 3, p 104-105, 1977. 3 Fig. 3 Ref.

Descriptors: \*Research equipment, \*Daphnia, Lab-oratory equipment, Equipment, Monitoring, Animal metabolism, Animal physiology, Respira-tion, \*Phenols, Toxicity, Bioassay, Electrical equipment, Optical properties.

An apparatus for the automatic recording of respiration and cardiac activity in Daphnia is described. The device utilizes an optical system in which a light flux is passed through the transparent body of the Daphnia. Cardiac or respiratory movement alters the beam, which is detected by a photoresistor. A counter or electro-cardiograph is used to quantify the changes in the light. Test with Daphnia in pure lake water and in phenol confirmed its suitability for such investigations. (Deal-EIS)

THE CHRONIC EFFECT OF ALKALI ON THE GROWTH, DEVELOPMENT AND FECUNDITY OF THE GUPPY,

Tsentralnyi Gosudarstvennyi Nauchno-Issledova-telskii Inst. Ozernogo i Rechnogo Rybnogo Kho-zyaistva, Baku (USSR). Azerbaijan Branch.

Sh. A. Rustamova. Hydrobiological Journal, Vol 13, No 3, p 83-85, 1977. 8 Ref.

Descriptors: \*Toxicity, \*Alkalis(Bases), \*Fish physiology, Growth rates, Fecundity, Fish reproduction, Mortality, Sodium compounds, Carbonates, Water chemistry, Fresh water fish, Sodium hydroxide, Sodium carbonate, \*Guppies, \*Le-

The chronic effects of low concentrations (25 to 100 mg/liter) of NaOH and Na2CO3 in several generations of guppies were elucidated in long-term tests. The survival and weight increase of the fish declined, sexual maturity was late or premature, fecundity was low, the quality of the progeny deteriorated and the fishes gradually died out. Sodium hydroxide concentrations of 25 mg/liter and over are toxic, as are those of 50 mg/Na2CO3/liter and over. (Deal-EIS)

METERING DEVICE FOR TOXICANTS USED IN BIOASSAYS WITH AQUATIC ORGANISMS,

Canada Centre for Inland Waters, Burlington (On-

tario).
P. V. Hodson.
The Progressive Fish Culturist, Vol 41, No 3, p 129-131, 1979. 1 Fig., 6 Ref.

Descriptors: \*Research equipment, \*Bioassay, Methodology, Laboratory equipment, Equipment, Pumps, Research and development, Monitoring, Laboratory tests, Siphons, Testing, Toxicity, Toxi-

A metering device for assuring accurate and continuous delivery of toxicants into continuous flow-through bioassay systems is described. The meter has the advantages of being fail-safe and no moving parts. The metering system has been in use by the authors for more than four years in bioassays lasting up to a year. (Deal-EIS)

RED SWAMP CRAYFISH: SHORT-TERM EF-FECTS OF SALINITY ON SURVIVAL AND

GROWTH, Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lah

Marine Lab.

B. A. Sharfstein, and C. Chafin.
The Progressive Fish Culturist, Vol 41, No 3, p 156-157, 1979. 1 Fig. 2 Ref.

Descriptors: \*Crayfish, \*Growth rates, \*Salinity, Aquiculture, Toxicity, Animal physiology, Water chemistry, Mortality, Aquatic animals, Salt tolerance, Crustaceans, Commercial shellfish, \*Procamance, Crustaceans, Crustaceans, Commercial shellfish, \*Procamance, Crustaceans, Crustacea

The ability of red swamp crayfish (Procambarus clarkii) to survive and grow during a one-month exposure to salinities ranging from 0 to 12 o/oo (0,3,6,9,12) Was investigated. Crayfish survived, molted, and grew at all test salinities; cast exoskeletons were found in all the culture tanks. Individuals in the 3 to 12 o/oo treatments lost their usual reddish tinge, and became a mottled green-gray. One death occurred in a 12 o/oo replicate 1 day before the end of the experiment. Average growth rate during the experimental period was inversely correlated with increasing salinity (r = -0.085). The highest average weekly growth rate, 17.2%, was in the 10 o/oo replicates. Growth rates in the 3.6, and 9 o/oo treatments were intermediate between these two and differed little at 11.7, 11.8 and 12.7%, respectively. (Deal-EIS)

PHYSIOLOGICAL MECHANISMS OF THE ACTION OF TOXIC SUBSTANCES, AND AD-APTATION OF AQUATIC ANIMALS TO

THEM, Akademiya Nauk SSSR, Borok Inst. Biologii Vnutrennykh Vod.

Hydrobiological Journal, Vol 13, No 4, p 70-74, 1977. 17 Ref.

Descriptors: \*Toxicity, \*Daphina, \*Organic compounds, \*Phenols, Pesticide toxicity, Mortality, Animal physiology, Cytological studies, Adaptation, Animal populations, Aquatic populations, Mode of action, \*Lindane, \*Chlorofos, \*Trichlor-

The present paper describes investigations of the effect of such widely distributed toxic compounds as phenol, Chlorofos (Russian equivalent of Trichlorfon) and benzene hexachloride on the physiological functions of aquatic animals, their action at the cellular, organism, and population levels, and also the possibilities and modes of adaption of aquatic animals to these toxic agents. Phenol acted as an uncoupler of oxidative phosphorylation, depressing active sodium transport and other processes connected with utilization of high-energy compounds. Chlorofos interfered with nervous accompounds. Chlorofos interfered with nervous accompounds. compounds. Chlorofos interfered with nervous ac-tivity via its anticholinesterase activity. Benzene hexachloride (lindane) was found to disturb synap-tic transmission. Features of the effect of toxic

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ediments, of flatfish Humber source of (Mc). Revariation a) of the re used to on. Slopes ies-specif-vels were owed sea-time zinc ersely re-2 years of

rowth; but ecrease to . No geo-correlated easons for onal vari-

### Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A-Identification Of Pollutants

substances are exemplified by reference to Daphnia pules. It is concluded that there is an absence of individual adaptation of organisms to toxic sub-stances and it is shown that the main mechanism of stances and it is shown that the main mechanism of adaptation of populations is the selection of resistant individuals, this being a non-specific mechanism. (Deal-EIS)
W80-01057

ABILITY OF CHIRONOMID LARVAE TO COLONIZE SUBSTRATES VARIOUSLY POSITIONED IN A LAKE, Moscow State Univ. (USSR).

Hosew State only (COSK).
A. S. Konstantinov.
Hydrobiological Journal, Vol 13, No 4, p 11-14, 1977. 1 Tab, 7 Ref.

Descriptors: \*Diptera, \*Habitats, \*Larval growth stage, Lakes, Periphyton, Aquatic insects, Aquatic populations, Biomass, Light penetration, Depth, Methodology, Monitoring, \*Substrates.

In the present work information is given on colonization by chironomid larvae-one of the commonest components of freshwater periphyton- of substrates in relation to the orientation of such strates and their position in the water body. Wood planks, placed horizontally or vertically at various depths, were used as substrates. The mean concentration of larvae on horizontal planks was approximately one and a half times greater than that on vertical surfaces. In horizontal planks the concentrations of larvae on the bottom side was approximations of larvae on the bottom side was approximations. vertical striaces. In horizontal plants in econceri-trations of larvae on the bottom side was approxi-mately half that on the upper side. With depth of immersion, the concentration of chironomia larvae on the upper side of the horizontal plants at first increases and then falls off, reflecting a systematic change in favorable conditions with depth. (Deal-EIS) W80-01058

TOXICITY OF SOME HEAVY METALS FOR DAPHNIA MAGNA STRAUSS, AS A FUNCTION OF TEMPERATURE,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiolo-

E. P. Sheherban. Hydrobiological Journal, Vol 13, No 4, p 75-80, 1977. 2 Fig, 15 Ref.

Descriptors: \*Daphnia, \*Toxicity, \*Heavy metals, \*Water temperature, \*Copper, \*Zinc, \*Cadmium, \*Nickel, \*Manganese, Bioassay, Growth stages, Mortality, Animal behavior, Crustaceans.

The effect of sulfate salts of copper, zinc, cadmi-um, nickel, and manganese on young Daphnia magna Strauss and on the sexually mature females in acute experiments (24, 48, and 72 hours) at 10, in actue experiments (24, 46, and 72 nours) at 10, 15, 25, and 30C is described. The toxicity of Cu2+, Zn2+, Cd2+, Ni2+andMn2+, increases with temperature. In the temperature interval from 25 to 30C toxicity of cadmium increases by three to four orders of magnitude, that of copper and zinc by two orders. Nickel and manganese are of relativally but vorcicity. (Deal, EIS) relatively low toxicity. (Deal-EIS) W80-01059

THE MARINE LIFE OF AN OFFSHORE OIL PLATFORM,
International Biological Consultants, Encinitas,

CA.
A. Wolfson, G. Van Blaricom, N. Davis, and G. S.
Lewbel.

Marine Ecology-Progress Series, Vol 1, p 81-89, 1979. 4 Fig, 2 Tab, 26 Ref.

Descriptors: \*Offshore platforms, \*Habitats, \*Dominant organisms, California, Marine plants, Marine animals, Aquatic populations, Oil, Mussels, Productivity, Trophic level, Biomass, Fouling, Benthic fauna, Polychaetes, Huntington Beach, \*Species diversity.

The research at Union Oil Platform EVA, off Huntington Beach, California, USA, was aimed at understanding how man-made offshore structures function as artificial reefs and how they modify the surrounding marine environment. Underwater surveys were conducted to determine: (1) the distributions of the conducted to determine: (1) the distributions of the conducted to determine: (2) the distributions of the conducted to determine: (3) the distributions of the conducted to determine: (4) the distributions of the conducted to the con

tion, standing stock and productivity of attached 'fouling' organisms, (2) the density, size-structure, and biomass of epibenthic populations beneath the platform, and (3) the abundance, species composition and distribution of epifaunal and infaunal benthos as a function of distance away from EVA. benthos as a function of distance away from EVA. The platform substructure is overgrown with dense clumps of sea mussels. An estimated cubic meter of mussels falls from the platform each day, supporting extraordinary densities (29 m·2) of sea stars on the bottom. Sea stars are prevented from climbing up onto the platform by bands of stinging sea anemones on EVA's base. The adjacent sand community is strongly influenced by EVA's presence with densities of some species greatly enhanced and others significantly reduced by proximity to the structure. A trophic model of dominant faunal elements in the oil platform ecosystem indicates high productivity and turn-over for the attached community. (Deal-EIS) W80-01060

ABORTION EFFECT IN CORALS INDUCED BY OIL POLLUTION, Tel Aviv Univ. (Israel). Dept. of Zoology. Y. Loya, and B. Rinkevich. Marine Ecology-Progress Series, Vol 1, p 77-80, 1979. 2 Fig. 21 Ref.

Descriptors: \*Oil pollution, \*Toxicity, \*Coral, Coral reefs, Reproduction, Oil, Oil spills, Organic compounds, Larval growth stage, Reefs, Mortality, Metabolism, Physiology, \*Crude oil, Iranian crude, Gulf of Eilat.

Sublethal concentrations of Iranian crude oil induce immediate mouth-opening in the Red Sea coral Stylophora pistillata, followed by premature extrusion of planulae larvae. Laboratory experiments with different concentrations of water soluble fractions(WSF) of Iranian crude oil (0.1-10.0 ml/l) showed that the average number of planulae extruded in each oil concentration was significantly higher than in the control. In natural conditions by light main the control. In lattrat conditions S. pistillata sheds its planulae only during the night. In presence of WSF of crude oil, shedding is immediate, day or night. Sheddingof planulae during an oil spill decreases their viability and during an oil spill decreases their viability and chances of successful settlement. In chronically oil-polluted reefs, such as the coral nature reserve of Eilat, almost no colonization of new coral colonies occurs, while high colonization is evident in reef areas free of oil pollution. (Deal-EIS) W80-01061

UPTAKE AND ACCUMULATION OF CADMI-UM BY OPHRYOTROCHA DIADEMA (POLY-

CHAETA), Anstalt Helgoland Hamburg. (Ger-Biologisch many, F.R.). K. Klockner

Marine Ecology-Progress Series, Vol 1, p 71-76, 1979. 3 Fig, 28 Ref.

Descriptors: \*Absorption, \*Cadmium, \*Polychaetes, Benthic fauna, Heavy metals, Water chemistry, Sea water, Reproduction, Path of pollutants, Animal physiology, Growth stages, Sorption, Chemical analysis, Spectrophotometry, \*Bioaccumulation, \*Tissue analysis, \*Ophryotro-

Cadmium uptake by the deposit-feeding polychaete, Ophryotrocha diadema, is a non-linear process related to exposure time and metal concentration in ambient seawater (20C; 31 o/ooS). Maximum body loads of 1700 ppm Cd were found in adult worms (up to 0.1 mg dry weight) after 64-day exposure to 1000 ppb Cd. Distinct saturation of absorption was not reached during this time. Accumulation factors decreased exponentially with increasing contamination levels. Accumulation factors were 7900 to 1700, calculated on a dry weight basis, corresponding to 3400 to 660 estimated on a theoretical volume basis of single worms in levels of 10 to 1000 ppb Cd. Cd content of 62- to 116-day-old worms of three consecutive generations subjected to permanent contamination did not increase from the P- to the P2-generation. A linear correlation exists between Cd absorption of newly deposited egg masses and experimental Cd concen-

trations. Cd loads of egg masses were extremely (12 to 280 ppm Cd dry weight in 50 to 1000 ppb Cd contamination) compared with parental organisms. Cd content of the egg masses also did not increase within consecutive generations. It is, therefore, assumed that parentally accumulated Cd loads are not transferred to the offspring. Contamination of egg masses probably occurred after spawning, due to sorption of the metal by the mucoid layer encapsulating the eggs, since similar results were noted for Cd sorption by food particles (fragmented spinach). (Deal-EIS) W80-01062

EFFECTS OF OXYGEN TENSION ON PUMP-ING, FILTRATION AND OXYGEN UPTAKE IN THE ASCIDIAN PHALLUSIA MAMMILLATA,

Paris-6 Univ. (France). Lab. Arago.
A. Fiala-Medioni.
Marine Ecology-Progress Series, Vol 1, p 49-53, 1979. 3 Fig. 3 Tab, 13 Ref.

Descriptors: \*Oxygen requirements, \*Animal metabolism, Animal physiology, Animal behavior, Water chemistry, Oxygen, Filtration, Dissolved oxygen, Analytical techniques, Mollusks, Clams,

The effects of declining oxygen tension on pumping, filtration and oxygen uptake were studied simultaneously in Phallusia mammillata. Identical effects were observed on rates of pumping and filtration; these remain constant until the oxygen tension (p.02) falls to a mean level of 119 mm Hg (concentration = 3.85 ml 02.0) and then decrease. (concentration = 3.85 mil 02/1) and then decrease. Below a p02 of 98 mm Hg (3.18 mil 02/1) the raste decrease more rapidly and become more variable. No particular rhythms emerged. Below a p02 of 119 mm Hg, rapid and rhythmic variations in the diameter of the cloacal siphon produce a pseudonauther. Efficiency efficiency of the contents with diameter of the cloacal siphon produce a pseudor-hythm. Filtering efficiency stays constant, with values of 77 to 79%. The mechanism of mucus formation is not affected down to a pO2 of 98 mm Hg. Below a mean pO2 of 119 mg Hg - the critical tension - oxygen uptake decreases; P. mammillata fails to regulate oxygen consumption, and becomes a 'conformer'. (Deal-EIS) W80-01063

PERSISTENCE OF POLYCHLORINATED BI-PHENYLS AND 1,1-DICHLORO-2,2-BISGP-CHLOROPHENYL) ETHYLENE (P.P-DDE) WITH AGE IN LAKE TROUT AFTER 8 YEARS, Cornell Univ., Ithaca, NY. Dept. of Food Science P. C. Wszolek, D. J. Lisk, T. Wachs, and W. D.

Environmental Science and Technology, Vol 13, No 10, p 1269-1271, 1979. 2 Fig, 1 Tab, 39 Ref.

Descriptors: \*Pesticide residues, \*Persistene, \*Lake trout, New York, Polychlorinated biphenyls, DDE, Chlorinated hydrocarbon pesticides, Chemical analysis, Aroclors, Path of pollutants, Age, Public health, \*Tissue analysis, \*Bioaccumulation.

Lake trout, ranging in age from 6 to 12 years, were netted in Cayuga Lake in Central New York in 1978 and analyzed for polychlorinated biphenyls (PCBs) and 1,1-dichloro-2,2-bis(p-chlorophenyl)ethylene (p,p-DDE). Fresh weight concentrations in flesh of the 12-year old fish were about 13 ppm of PCBs and 3-4 ppm of p,p-DDE. The data indicated that, whereas p,p-DDE had decreased considerably, PCB concentrations remained about the same as those in a similar series of aged lake trout sampled from Cayuga Lake in 1970. The PCBs present in the fish most closely resembled Aroclor 1254 but appeared to contain a higher proportion of more highly chlorinated isomers. (Deal-EIS)

TEMPERATURE AND SALINITY EFFECTS ON THE ACUTE TOXICITY OF CADMIUM TO LAOMEDEA LOVENI (HYDROZOA), Kiel Univ. (Germany, F.R.). Inst. fuer Meeres-

H. Theede, N. Scholz, and H. Fisher.

Marine Ecology-Progress Series, Vol 1, p 13-19,

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olerance Laomed The hyd water (m Cd is stre temperati temperati

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### Identification Of Pollutants-Group 5A

1979, 3 Fig. 4 Tab, 42 Ref.

Descriptors: \*Cadmium, \*Toxicity, \*Water temperature, \*Salinity, Heavy metals, Sea water, Salt tolerance, Absorption, Bioindicators, Bioassay, \*Bioaccumlation, \*Tissue analysis, \*Polyps, \*Laomedea, Marine animals.

The hydroid polyp Laomedea loveni Allm. responds to very low cadmium concentrations in sea water (microg Cd/I range). The acute toxicity of Cd is strongly modified by abiotic factors. At low temperatures and high salinities L. loveni is more tolerant to Cd contamination than at the reverse temperature-salinity combinations. The Cd concentration causing irreversible retraction of 50% of the hydranths after a 7-day exposure of polyp colonies (7d ED50) varies from 3 microg 1-1 (at 17.5C and 10 o/ooS) to 80 microg 1-1 (at 7.5C and 25 o/ooS). The accumulation of Cd increases at higher temperatures. (Deal-EIS)

TOXICITY OF COPPER COMPOUNDS FOR CHLORELLA PYRENOIDOSA BEYER, Moscow City Council (USSR). Inst. for the Design and Planning of the Water Supply and

Sewer Systems.

G. K. Barashkov, and N. M. Kiristayeva.
Hydrobiological Journal, Vol 13, No 4, p 80-83, 1977. 1 Fig. 1 Tab, 12 Ref.

Descriptors: \*Toxicity, \*Copper, \*Chlorella, Analytical techniques, Chemical analysis, Monitoring, Copper compounds, Copper sulfate, Aquatic algae, Biomass, Chlorophyta, Nitrates, Chlorides, Biomass,

A new method for quantitative assessment of relative toxicities of some copper compounds on algae showed that these vary by a factor of 235. Distortions in the results by the biomass effect can be avoided by introducing an internal standard of toxicity based on CuSO4 and expressing the results in units of toxicity (toxae). Our data show the necessity of supplementing the system of monitoring surface-water quality with direct determinations of toxicity via biological tests. (Deal-EIS) W80-01066

OBSERVATIONS OF MERCURY LEVELS IN BRANCHIOSTOMA CARIBAEUM, Swedish Water and Air Pollution Research Lab., Stockholm.

A. Jernelov, O. Linden, and L. Lindestrom.

Marine Pollution Bulletin, Vol 10, p 258-259, 1979.

Descriptors: \*Mercury, \*Benthic fauna, \*Baseline studies, Chemical analysis, Industrial wastes, Chemical wastes, Heavy metals, Path of pollutants, Sampling, Absorption, Cartagena Bay, Colombia, \*Cephalocordates, \*Branchiostoma, \*Lancelets.

This report presents baseline data on mercury levels in cephalocordates. Lancelets (Branchiostoma caribaeum) were collected in bottom samples in Cartagena Bay Colombia at various distances from the mercury source. Mercury content was determined by the flameless atomic absorption method. The mercury concentrations ranged from 24 to 360 ppb. Factors influencing mercury levels were distance from the mercury source and prevailing currents in the bay. (D-EIS)

ACCUMULATION OF MERCURY AND SELE-NIUM IN CULTURED YELLOWTAIL, Shimonoseki Univ. of Fisheries (Japan). Dept. of Food Science and Technology. M. Takeda, and T. Ueda. Bulletin of the Japanese Society of Scientific Fisheries, Vol 45, No-7, p 901-904, 1979. 7 Fig, 10 Ref.

Descriptors: "Mercury, "Absorption, Agriculture, Fish physiology, Path of pollutants, Chemical analysis, Heavy metals, Chemical properties, Growth stages, Animal metabolism, Food webs, "Selenium, "Bioaccumulation, "Tissue analysis, "Yellowtail, "Beriola, "Methylmercury.

The accumulation of mercury and selenium in dif-ferent tissues were followed by using commercially cultured young yellowtail, Seriola quinqueradiata. The levels of mercury increased significantly with growth in dorsal muscle of the fish fed mainly with growth in dorsal muscle of the fish fed mainly with sardines (mean mercury level is 0.05 microg/g) and these concentrations were at similar levels to those of wild fish. On the other hand, the mercury levels in dorsal muscle of yellowtail fed with mackerel(mean mercury level is 0.09 microg/g) alone were higher than those fed with sardines. The mercury level of liver was lower than that of dorsal muscle and independent of the latter. Heart issue contained the highest amount of mercury among the organs analyzed. The mean ratios of methylmercury to total mercury of dorsal and dark muscle were about 65 and 85%, respectively. The correlation between the level of selenium and that of total mercury was significant in dorsal muscle. The mean molar ratios of selenium to mercury in dorsal, dark, and abdominal muscle were 19, 28, and 19, respectively. (Deal-EIS) and 19, respectively. (Deal-EIS)

THE EFFECT OF SEWAGE AND INDUSTRIAL WASTE DISCHARGES ON THE PRIMARY PRODUCTION OF A SHALLOW TURBULENT

Vikram Univ., Ujjain (India). School of Studies in

S. V. R. Rao, V. P. Singh, and L. P. Mall. Water Research, Vol 13, p 1017-1021, 1979. 8 Tab,

Descriptors: \*Sewage effluents, \*Industrial wastes, \*Primary productivity, \*Toxicity, Turbulence, Rivers, Respiration, Productivity, Flow rates, River flow, Tropical regions, Water chemistry, Seasonal, Water pollution effects, River Khan, \*India Pladia | Pladia |

Sewage and industrial waste discharges have been found to have a deleterious effect on the primary productivity of the shallow turbulent tropical river Khan (Indore) India. Even though net primary productivity of the shallow turbulent tropical river Khan (Indore) India. Even though net primary production rates have exceeded the respiration rates in the early recovery zone, the industrial wastes and sewage discharges have been found to decrease the overall productivity of the river. The above studies have been compared with other investigations in the temperate regions of the world, which generally refer to the effects of organic pollution on the primary productivity of the running which generally refer to the effects of organic pollution on the primary productivity of the running waters. The present investigations lead to a generalized observation that in tropical running waters, toxic industrial wastes and sewage discharges have a depressing effect on the overall production rates. However, comparable studies in the temperate regions are nonexistent, as the studies in the temperate regions mainly refer to organic pollution and do not take into account the effects of toxic industrial waste and sewage discharges. (Deal-EIS)

AN INVESTIGATION ON THE MERCURY CONTAMINATION OF PERSIAN GULF FISH, Tehran, Univ. (Iran). Dept. of Food Hygiene.

V. Parvaneh.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 357-359, 1979. 1 Tab, 12 Ref.

Descriptors: \*Baseline studies, \*Mercury, \*Commercial fish, Chemical analysis, Fish physiology, Path of pollutants, Heavy metals, Public health, Spectrophotometry, Marine fish, \*Persian Gulf, \*Tissue analysis, \*Bioaccumulation.

The present study was performed to establish baseline data on the mercury content of Persian Gulf fish. Random samples of the four most important fish, Cybium comersonii, C. guttatum, Lutjanus coccineus and Psettodes erimei as well as samples of canned tuna (Euthynnus offinis) were analysed. Samples of the edible parts of the fish were studied using flameless atomic absorption spectrophotometry. The level of mercury ranged from 0.04 to 0.56 mg/kg. Tuna had the highest mean concentration, 0.30 mg/kg, followed by L. coccineus, 0.19,

C. comersonii, 0.17, P. erumei, 0.15, and C. guttatum, 0.14. (Deal-EIS) W80-01070

IN VIVO AND IN VITRO EFFECT OF PHENO-CLOR DP6 ON DRUG METABOLIZING AC-TIVITY IN MULLET LIVER, Bordeaux Univ., Talence (France). Lab. de Phy-siologie de la Nutrition. J. F. Narbonne, and J. L. Gallis. Bulletin of Environmental Contamination & Toxi-cology, Vol 23, p 338-343, 1979. 2 Tab, 30 Ref.

Descriptors: \*Polychlorinated biphenyls, \*Toxicity, \*Enzymes, Fish physiology, Animal metabolism, Mode of Action, Biochemistry, Fish diets, Path of pollutants, Mullets, \*Tissue analysis, \*Liver, \*Phenoclor.

\*Liver, \*Phenoclor.

This paper describes the effects of Phenolor DP6 on mixed function oxidase system activities in hepatic microsomes of estuarine fish. Two groups of mullet (Chelon labrosus) were used. One group was fed a diet containing 50 microg/g Phenoclor D6 while the other group served as control. After eight days of feeding all fish were sacrificed and the livers were analysed. Liver hydroxylase and demethylase activities as well as cytochrome P450 and cytochrome b5 contents are significantly increased in treated fish, rising from 63 to 118 per cent with respect to control values. Aniline hydroxylase activity and cytochrome b5 concentration are more sensitive to DP6 treatment than aminopyrine-N-demethylase and cytochrome P450. However, as has been shown in rat liver studies, the last two microsomal parameters correlate very well. The results of the present study clearly indicate the ability of PCB to induce the fish hepatic drug metabolizing enzymes. (Deal-EIS) FIS) W80-01071

ACUTE TOXICITY TO SELENASTRUM CA-PRICORNUTUM OF AROMATIC COM-POUNDS FROM COAL CONVERSION, Oak Ridge National Lab. TN. J. M. Giddings. Bulletin of Environmental Contamination & Toxi-cology, Vol 23, p 360-364, 1979. 1 Tab, 9 Ref.

Descriptors: "Toxicity, "Aromatic compounds, "Aquatic algae, Coals, Organic compounds, Fuels, Phenols, Photosynthesis, Tracers, Radiochemical analysis, Inhibition, Metabolism, Aromatic hydro-carbons, Quinones, "Selenastrum, "Synthetic fuels, Aromatic amines, Azarenes, Thiophenes, Aniline, Naphthylamine, Naphthol.

Naphthylamine, Naphthol.

This paper presents results of experiments on the effects of aromatic compounds on photosynthesis in a freshwater alga. The classes tested were unsubstituted aromatic hydrocarbons, aromatic quinones, aromatic amines, methylated aromatics, phenols, azaarenes, and thiophenes. Each toxicant was tested at three concentrations, with two replicates per concentration. Photosynthesis was determined by measurement of carbon-14 fixation. Benzoquinone and naphthoquinone were the most toxic compounds tested. Anthraquinone, presumably due to its insolubility, was essentially nontoxic to S. capricornutum, as were all of the ot her 3-ring compounds except acridine. Aromatic amines (aniline and naphthylamine) were highly toxic, as was naphtnol. Thiophenes and azarenes were only slightly toxic except at the highest concentrations. The other classes of aromatic compounds were intermediate in toxicity. In all cases, 2-ring compounds. Results on the relative toxicities of the compounds tested are in agreement with previously published results, in the few instances where comparisons are possible. (D-EIS)

EFFECT OF SELECTED WATER TOXICANTS
AND OTHER CHEMICALS UPON ADENOSINE TRIPHOSPHATASE ACTIVITY IN
VITRO,

Environmental Research Lab. Duluth, MN. B. Riedel, and G. Christensen.

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PUMP-AKE IN LLATA, p 49-53.

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### Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A-Identification Of Pollutants

Bulletin of Environmental Contamination & Toxicology, Vol 23, p 365-368, 1979. 1 Tab, 27 Ref.

Descriptors: \*Inhibition, \*Enzymes, \*Analytical techniques, Heavy metals, \*Mercury, \*Copper, \*Cadmium, Pesticide toxicity, \*DDT, \*Dieldrin, \*Nickel, \*Cobalt, \*Aluminum, Chemical properties, Salts, Chemical analysis, Metabolism, \*Silver, \*Lindane, \*Malathion, \*Carbaryl, \*Ouabain.

Nineteen selected chemicals from structurally different chemical classes, most of them water pollutants, were studied for inhibitory effects on ATPase. The test chemicals used in this study were (reagent grade): AgNO3, CuCl2, CdCl2.2H2), AlCl3, NsiCl2.6H2O, CoCl2.6H2O, NaCl, NaZS, NaF, CH3HgCl, malathion, carbaryl, lindane, dieldrin, DDT, dicofol, ouabain, and eserine (physostigmine). Salts of language and the studies studied, the arylorganochloride pesticide dicofol was the strongest inhibitor, followed by DDT, dieldrin, lindane, carbaryl, and malathion, carbartes as the strongest inhibitor, followed by DDT, dieldrin, lindane, carbaryl, and malathion, considered a potent inhibitor of Na+1/K+1-ATPase, was about 375 times less reactive than Ag+1. An intermediate effect on activity was found for Al+3, F-1, Ni+2, and Co+2. No measureable effect was discernible for \$-2\$ and NaCl. The toxic effect of heavy metal salts and some of the organometals and organochlorine pesticides might be caused by interruptions of energy-mobiling acceptance and the supplementations of energy-mobiling acceptance and the supplementations of energy-mobiling acception and the supplementations of energy-mobiling acception and the supplementations of energy-mobiling acceptance and the supplementations of energy-mobiling acceptance and the supplementations of the supplementation of the su Nineteen selected chemicals from structurally difmight be caused by interruptions of energy-mobilizing and sensory-transmitting systems, of which ATP and its associated enzymes are an integral part. It seems unlikely that the organophosphate and carbamate pesticides exert a primary deleterious effect through ATPase inhibition, although a long exposure time and a high degree of bioaccu-mulation, coupled with a low rate of metabolic degradation could ultimately bring about an effect.

MIREX RESIDUES IN EGGS AND LIVERS OF TWO LONG-LIVED REPTILES (CHRYSEMYS SCRIPTA AND TERRAPENE CAROLINA) IN MISSISSIPPI, 1970-1977, Mississippi Univ. for Women, Columbus. Dept. of Physical Sciences.

Mississippi Carlos Physical Sciences.

C. M. Holcomb, and W. S. Parker.

Bulletin of Environmental Contamination & Toxicology, Vol 23, p 369-371, 1979. 1 Tab, 5 Ref.

Descriptors: \*Pesticide residues, \*Turtles, \*Path of pollutants, Reptiles, Growth stages, Insecticides, Chlorinated hydrocarbon pesticides, Chemical analysis, Gas chromatography, Pesticide kinetics, Trophic level, \*Tissue analysis, \*Bioaccumulation,

Animals for the study were obtained from a location that received four applications of mirex over eight years at a concentration of 5% for fire ant control. Specimens were collected in 1970, 1972, 1974, 1975, and 1977. Significant levels of mirex were detected in both livers and eggs of both species of turtle. Mirex residues were consistently higher in livers of ox turtles than in sliders, and to a lesser extent in eggs as well. Peak residues in livers of both species occurred in 1972, 2.5 years after the last application of mirex bait. Residues declined after 1972, despite an application in 1974 which had no apparent effect on residues in sliders in 1977. (Deal-EIS)

OIL CHANGE IN EXCRETORY PRODUCTS OF MUSSELS (MYTILUS GALLOPROVINCIA-LIS),

Institute of Biology of the South Seas, Sevastopol

(USSR).
O. G. Mironov, and T. L. Shchekaturina.
Marine Pollution Bulletin, Vol 10, p 232-234, 1979.
2 Fig. 4 Tab, 7 Ref.

Descriptors: \*Oil, \*Biodgradation, \*Mussels, Animal metabolism, Animal physiology, Path of pollutants, Aromatic compounds, Organic com-pounds, Chemical analysis, Biochemistry, Gas chromatography, \*Mytilus, \*Tissue analysis, \*Ali-phatic compounds.

Oil ingested by mussels appears in the feces and pseudo-feces but differs in composition from the oil to which the animals are exposed. It contains more heavy fractions and larger aromatics, and there is a shift of aliphatic hydrocarbons towards heavier alkanes and isoprenoids. There is evidence that these changes are the result of metabolic processes in the mussels. (Deal-EIS) W80-01075

SEDIMENT PENETRATION OF AMOCO CADIZ, OIL, POTENTIAL FOR FUTURE RE-LEASE, AND TOXICITY, Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.

J. H. Vandermeulen, D. E. Buckley, E. M. Levy,
B. F. N. Long, and P. McLaren.
Marine Pollution Bulletin, Vol 10, p 222-227, 1979.

5 Eig. 1 Tab. 15 Ref.

5 Fig. 1 Tab, 15 Ref.

Descriptors: \*Oil, \*Toxicity, \*Oil spills, Oil pollu-tion, Path of pollutants, Sediments, Bottom sedi-ments, Beaches, Chemical degradation, Chemical properties, Particle size, Sands, \*Crude oil, properties, Pa \*Amoco Cadiz.

Weathering states of oil ranging from sheen oil to mouse have significant effects during oil stranding on oil-water and oil-sediment interaction. Observa-tions of oiled sandy beaches suggest two mecha-nisms of beach contamination-general penetration and contamination of beach substrate by films of and contamination of beach substrate by films of sheen oil (probably partially emulsified), and secondly the burial of discrete layers of mouse. Depending on timing of oiling with respect to beach dynamics large amounts of stranded oil can be accommodated within beach sediments. These then become available for later long-term release. Acute tethal toxicity of stranded Amoco Cadiz oil is intermediate to Bunker C and Kuwait crude. Simulated activities the state of the substantial control of the substanti lated weathering studies suggest that there may be some increase in toxicity with weathering. (Deal-EIS) W80-01076

CELLULAR RESPONSES TO POLYCYCLIC AROMATIC HYDROCARBONS AND PHENOBARBITAL IN MYTILUS EDULIS, Institute for Marine Environmental Research,

Plymouth (England). M. N. Moore.

Marine Environmental Research, Vol 2, p 255-263, 1979. 1 Fig, 2 Tab, 27 Ref.

Descriptors: "Mussels, \*Enzymes, \*Aromatic compounds, \*Toxicity, Cytological studies, Animal metabolism, Animal physiology, Mode of action, Biochemistry, Analytical techniques, Chemical analysis, \*Phenobarbital, \*Phenanthrene, \*Naphthalenes, \*Mytilus, \*Tissue analysis.

Certain polycyclic aromatic hydrocarbons and phenobarbital induced an increase in the activity of microsomal NADPH neoterazolium reductase in microsomal NADPH neoterazolium reductase in the blood cells of Mytilus edulis. Phenanthrene and methylated naphthalenes caused lysosomal destabilisation which is believed to be directly related to the mechanism of cytotoxicity in the digestive cells. The use of these cytochemical techniques as indices of aromatic hydrocarbon contamination is discussed. Among the hydrocarbon tested are naphthalenes and phenanthrene. (Deal-EIS) W80-01077

THE RELATIONSHIP BETWEEN THE COPPER COMPLEXING CAPACITY OF SEA WATER ND COPPER TOXICITY IN SHRIMP

WATER NO COLLEGE
ZOEAE,
Battelle Pacific Northwest Labs., Sequim, WA.
Marine Research Lab.
J. S. Young, J. M. Gurtisen, C. W. Apts, and E. A.

Crecelius.

Marine Environmental Research, Vol 2, p 265-273, 1979. 2 Fig, 2 Tab, 14 Ref.

Descriptors: \*Copper, \*Toxicity, \*Shrimp, \*Growth stages, Larval growth stage, Mortality, Growth rates, Inhibition, Electrochemistry, Ions, Chemical analysis, Complexing capacity, \*Tissue analysis, \*Bioaccumulation, \*Pandalus.

Mortality of larval coon-stripe shrimp, Pandalus danae, was related to labile copper and the copper complexing capacity of sea water, as measured by differential pulse Anodic Stripping Voltammetry (ASV). In nominal treatments of control, 5 and 10 microg/litre Cu which contained less than 1.0 microg/litre ASV labile Cu, zoeal development was usually complete. In treatments of 20 and 50 microg/litre ASV labile Cu, most larvae died while in the first zoeal stage. ASV labile Cu was related to the copper complexing capacity of sea water. Copper toxicity at less than 1.0 microg/litre ASV labile Cu is indicated by moulting delay and apparent Cu accumulation in zoea of the 5 and 10 microg/litre Cu nominal treatments. (Deal-EIS) W80-01078

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FAILURE OF OSMOREGULATION WITH AP-PARENT POTASSIUM INTOXICATION IN MARINE TELEOSTS: A PRIMARY TOXIC EFFECT OF COPPER, Florida, Univ., Gainesville. Coll. of Veterinary

Nedicine. P. T. Cardeilhac, C. F. Simpson, R. L. Lovelock, S. F. Yosha, and H. W. Calderwood. Aquaculture, Vol 17, p 231-239, 1979. 5 Fig, 1 Tab, 16 Ref.

Descriptors: \*Copper, \*Toxicity, \*Oamosis, Fish physiology, Membrane processes, Potassiu, Fish behavior, Mortality, Chemical analysis, Chemical properties, Phosphates, Teleosts, Fish diseases, Mode of action, \*Sheepshead, \*Archosargus, \*Tierure activity.

Four sheepshead, Archosargus prob atocephalus, were exposed to toxic concentrations, (8.5 ppm) of cupric ion (copper) in sea water. Five stages of intoxication of increasing severity, based on behavior and posture, were designated as follows: lethargy; indifference; incoordination; moribundity; death. Serum, gills, liver, and kidneys were taken from fish at different stages of intoxication for examination. Kidneys were congested and swollen, the kidney wt/body wt index increasing up to 13.5 standard deviations (S.D.) over the mean control value. Gill lamellae from copper-poisoned fish were blunt and thickened, capillaries congested, and mucous cells dilated. Livers were similar to controls. Twenty-two clinical values were examined but only serum electrolytes and uric acid levels, liver and gill copper concentrations, kidney weights, and respiratory rates increased in poisoned fish by more than 5 S.D. over mean control values and correlated with the different stages of soned isn by more than 5 3.D. over mean control values and correlated with the different stages of intoxication. Increased serum potassium, inorganic phosphate, and total intracellular ion values gave highest correlations with severity of intoxication. Potassium levels reached values considered lethal for mammals, and it was concluded that the intoxication following copper poisoning was a potassium intoxication caused primarily by cell damage and failure of osmoregulation by the gills and kidneys. (Deal-ELS) W80-01079

THE RESPIRATORY RESPONSE OF JUVE-NILE MUD CRABS, RHITHROPANOPEUS HARRISII TO VARIATIONS IN SALINITY AND FOLLOWING SHORT-TERM EXPOSURE TO HALOWAX 1099, A POLYCHLORINATED NAPHTHALENE (PCN), Texas A and M Univ., College Station. Dept. of

Biology. R. B. Laughlin, Jr., and J. M. Neff.

Marine Environmental Research, Vol 2, p 275-286, 1979. 4 Fig, 1 Tab, 47 Ref.

Descriptors: \*Crabs, \*Toxicity, \*Organic compounds, \*Salinity, Chemical wastes, Chemical properties, Animal behavior, Animal physiology, Respiration, Osmosis, Crustaccans, Desalination processes, Salt tolerance, Animal metabolism, Mode of action, \*Polychlorinated naphthalene, \*Naphthalenes.

Juvenile mud crabs were exposed for five days to Halowax 1099, a polychlorinated naphthalene (approximately 1:1 ratio of tri- and tetrachlorinated isomers). Exposure concentrations were 0, 20, 50

Identification Of Pollutants—Group 5A

or 100 microg/litre. The exposure salinity was 15 o/oo. At the end of the exposure period, respiratory rates of the crabs were determined at 15 o/oo. The respiratory rates were also determined for control and exposed animals which were osmotically shocked by a move from 15 o/ooS to either 5 or 25 o/ooS immediately before respirometry. Exposure to PCNs always caused the mean respiratory rates of juvenile crabs to increase over control values. The respiratory response of crabs to PCN exposure was similar at the steady-state aslinity (15 o/ooS) and after hyperosmotic shock (25 o/ooS). However, the mean rate for animals exposed to PCNs and given a hyposmotic shock was significantly higher than that for controls and for PCN-exposed animals at the other two salinities. Since hyperosmotic regulation of body fluids a most active at low salinities in this species, we suggest that the PCNs interfere with hyperosmotic regulation and reduce the efficiency of metabolic compensation for hyposmotic shock. The higher energetic cost of acclimation to transient reductions in salinity would be potentially detrimental to wild populations in impacted areas. (Deal-EIS) W80-01080

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EFFECTS OF LOGGING ON STREAM ENVI-RONMENTS AND FAUNAS IN NELSON, Marine Dept., Wellington (New Zealand). Fisher-is Research Div.

Brezearch 18 (1997) Research Vol 13, No 1, p 79-109, 1979. 12 Fig. 12

Descriptors: \*Lumbering, \*Forest management, Streams, Habitats, Clear-cutting, Runoff, Watershed management, Erosion, Stream erosion, Accelerated erosion, Benthic fauna, Diptera, Brown trout, Mayflies, Aquatic insects, \*New Zealand, Oligochaetes, Sediments, Water temperature, Stope flies.

The effects of various logging practices on stream environments and faunas were studied at the Golden Downs State Forest in Nelson. Comparisons were made between the features of a control stream with an unmodified forest catchmen and these streams which are the control of the stream with an unmodified forest catchmen and three streams whose catchments had been affected by different logging practices. Measurements were made of stream flow, water temperature, stream bed sedimentation, suspended sediment and dis-solved solids concentrations, and the abundance of benthic invertebrates and fishes. Clearfelling to the stream's edge, together with inappropriate roading and bridging techniques, caused great changes in stream environments and faunas. Excessive amounts of waste timber and soil entered streams and stream bed loads, and suspended sediment and dissolved soil concentrations increased. In comdissolved soil concentrations increased. In com-parison to the control stream water temperatures mcreased in summer by up to 6.5C and decreased in winter by as much as 2.5C. In one stream the benthic invertebrate fauna was greatly modified; there was a reduction in the abundance of Plecop-tera and certain Ephemeroptera nymphs, and increase in the abundance of oligochaetes, chirono-mids, and Deleatidium nymphs. Fishes, Galaxias divergens and Anguilla dieffenbachi, were also re-duced in numbers in this stream. (Deal-EIS)

PREDICTING ROTENONE DEGRADATION IN LAKES AND PONDS,
New York State Dept. of Environmental Conser-

New York Glass Dept. Visition, Albany.
R. Engstrom-Heg, and R. T. Colesante.
New York Fish and Game Journal, Vol 26, No 1, p
2-36, 1979. 5 Fig, 1 Tab, 9 Ref.

Descriptors: \*Rotenone, Chemical degradation, Pesticide kinetics, Chemical properties, Water temperature, Pesticide toxicity, Piscicides, Light penetration, Fish management, Lakes, Epilimnion, Hypolimnion, Rotenone degradation.

The rate of natural degradation of rotenone in a lake was estimated by suspending rotenone solutions at a series of depths in clear and opaque plastic bags. Logarithms of rate constants for all deep samples and for surface and epilimnetic sam-

ples in opaque bags were proportional to tempera-ture. Light plays an important role in detoxifica-tion of surface waters. Equations were developed for estimating detoxification times and appropriate treatment dates in relation to the fall overturn for lakes and ponds under a variety of conditions. (Deal-EIS) W80-01082

AN INVESTIGATION INTO THE EFFECTS OF THE PISCICIDE ANTIMYCIN A ON THE FISH AND INVERTEBRATES OF A SCOTTISH STREAM,

Freshwater Fisheries Lab., Pitlochry (Scotland).

President States Lab., Printently (Scotland). B. R. S. Morrison. Fisheries Management, Vol 10, No 3, p 111-122, 1979. 1 Fig, 2 Tab, 21 Ref.

Descriptors: \*Antimycin A, \*Pesticide toxicity, \*Trout, Piscicides, Invertebrates, Streams, Benthic fauna, Aquatic insects, Diptera, Mollusks, Fish populations, Salmonids, Aquatic populations, Mayflies.

Field treatments are described in which the effects of antimycin A on fish and invertebrates in a highland stream were studied. Because of the limited ed extent of the fish kill during the first treatment in 1976, a second treatment was undertaken the following year when the exposure period was increased from 2 h to 5 and 6 h. The water level in both years was very low, generally only a few centimetres deep, but a concentration of 10 microg/I antimycin killed wild fish and the control fish which were held in cages in different parts of microg/l antimycin killed wild fish and the control fish which were held in cages in different parts of the stream. A significant decrease was noted in the numbers of Ecdyonurus spp. at one of the sampling sites after the 1976 treatment, and of Paraleptophlebia submarginata (Steph.) at one site after the 1977 treatment. No significant decrease was found in the populations of the other species collected after each treatment. It is concluded that trout according to the control of the after each treatment. It is concluded that trout populations in streams can be controlled effectively by antimycin applied at a concentration of 10 micro/l, provided the exposure period lasts for several hours. Antimycin does not appear to have an adverse effect on the invertebrate fauna as a whole. (Deal-EIS) W80-01083

THE EFFECT OF AMMONIA ON THE GROWTH OF JUVENILE DOVER SOLE, SOLEA SOLEA (L.) AND TURBOT, SCOPHTHALMUS MAXIMUS (L.), Ministry of Agriculture, Fisheries and Food, Port Erin (England). Fisheries Lab.

Aquaculture, Vol 17, p 291-309, 1979. 6 Fig, 5 Tab, 39 Ref.

Descriptors: \*Ammonia, \*Toxicity, \*Growth rates, Fish physiology, Animal metabolism, Juvenile growth stage, Water chemistry, Ions, Hydrogen ion concentration, Sea water, Aquiculture, Fish diseases, Chemical properties, \*Turbot, \*Scophthalamus, \*Sole, \*Solea, \*Tissue

The growth of sole and turbot was followed in are grown or sole and turrost was followed in groups of fish exposed to constant unionised ammonia concentrations at pH levels both at and below that of normal sea water. Low pH levels were produced by the addition of carbon dioxide. Results for both species showed evidence for a threshold level of unionised ammonia below which listen the conference of the carbon search of the carbon kesuits for soft species sinced evidence foliathreshold level of unionised ammonia below which little or no effect on growth was evident. This level was determined to be 0.066 mg N/1 for sole and 0.11 mg N/1 for turbot at 16C, 34o/oo salinity. The different pH conditions did not have any marked effect on these threshold levels. Above the threshold levels growth appeared to be depressed in a linear manner with increased unionised ammonia. The rate at which growth was depressed was greatest at the low pH levels for both species. The level at which growth ceased thus decreased from 0.77 to 0.38 mg N/1 for sole and from 0.9 to 0.3 mg N/1 for turbot, over the pH range from 7.9 to 6.9. The absence of disease and gill damage in the experimental populations is discussed. It is suggested that this and the tolerance shown by the fish, which is higher than is generally accepted for fish

in high density culture, may be due to the clean environment in which the fish were held while under test. (Deal-EIS) W80-01084

TOLERANCE OF DEVELOPING SALMONID EGGS AND FRY TO NITRATE EXPOSURE, Fish and Wildlife Service, Portland, OR. Div. of Ecological Services.

J. W. Kincheloe, G. A. Wedemeyer, and D. L.

Bulletin of Environmental Contamination & Toxicology, Vol 23, p 575-578, 1979. 2 Tab, 4 Ref.

Descriptors: \*Fish eggs, \*Toxicity, \*Nitrates, Fish management, Fish physiology, Growth stages, Fry, Water chemistry, Hardness(Water), Salmonids, Chinook salmon, Sockeye salmon, Rainbow trout, Cutthroat trout, Fish reproduction.

trout, Cutthroat trout, Fish reproduction.

A series of tests were designed to develop guidelines for allowable nitrate exposure in waters of
low total hardness needed to protect the egg and
early fry stages of chinook and coho salmon; anadromous (steelhead) and nonanadromous rainbow
trout, and Lahontan cutthroat trout, a threatened
species. Nitrate at 5-10 mg/L is mildly toxic to
developing eggs and the early fry stages of rainbow and steelhead trout. Chinook salmon and Lahontan cutthroat trout were affected only at exposure levels of 20 mg/L or higher. Coho salmon
were sufficiently resistant so that nitrate exposure
at the tested levels during incubation will probably
not be of concern. Thus, as a guideline, nitrate at
levels of 10 mg/L (2 mg/L NO3-N) in surface
waters of low total hardness would be expected to
limit survival of some salmonid fish populations
because of impaired reproductive success. In the
case of soft-water reuse hatcheries using biological
nitrification, egg incubation in recycled water
should be done with caution. Additional work is
needed to determine the point in fry development
at which tolerance to nitrate begins to increase to
adult levels (Deal-EIS) at which tolerance to nitrate begins to increase to adult levels. (Deal-EIS)
W80-01085

RECOVERY OF 14C-LABELLED POLYCHLO-RINATED BIPHENYLS (PCB) IN FISH TISSUE USING A COMBUSTION AND A SOLUBILIZA-TION METHOD OF SAMPLE PREPARATION FOR SCINTILLATION ANALYSIS, Canada Centre for Inland Waters, Burlington (On-

tario),
A. J. Nilimi, and G. A. Burnison.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 597-600, 1979. 1 Tab, 13 Ref.

Descriptors: \*Analytical techniques, \*Pollutant identification, \*Radiochemical analysis, Polychlorinated biphenyls, Aroclors, Rainbow trout, Daphnia, Chlorella, Tracers, Carbon radioisotopes, Methodology, Chemical analysis, \*Liquid scintillation analysis, \*Tissue analysis.

Liquid scintillation analysis for 14C in most biological materials require some preparation to render the sample suitable for counting. Use of a tissue solubilizer is by far the most common practice, although an oxidative combustion method has been used. This study evaluated the two methods to determine if one was more desirable than the other. 14C-labelled Arcolor 1242 was incorporated into the tissues of rainbow trout through a laboratory food chain. Samples of trout were then analyzed using either the oxidation combustion process or the tissue solubilizer (NCS) method. For most replicates, no significant differences in the mean recovery level was demonstrated between two treatments at PCB tissue concentrations of 2-7600 ng/g. This was due in part to the large variations of the NCS treated samples at PCB concentrations below 220 ng/g. The oxidative combustion method was able to measure the labelled compound in the pg/g range, while the NCS treatment was not able to consistently provide measurements above background levels. (Deal-EIS) Liquid scintillation analysis for 14C in most biovide meas (Deal-EIS) W80-01086

IDENTIFICATION OF TRANS-NONACHLOR IN GOBY-FISH FROM TOKYO BAY,

### Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A-Identification Of Pollutants

Tokyo Metropolitan Research Lab. of Public Heaith (Japan). T. K. Miyazaki, K. Akiyama, S. Kaneko, S. Horii,

and T. Yamagishi.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 631-635, 1979. 2 Fig, 13 Ref.

Descriptors: \*Pesticide residues, \*Pollutant identi-Descriptors: "Pesticiae residues, "Foliutant identification, "Gas chromatography, Chlorinated hydrocarbon pesticides, DDE, Polychlorinated biphenyls, Chemical analysis, Chemical properties, Spectrophotometry, Laboratory tests, "Nonachior, "Tissue analysis, "Bioaccumulation, "Chlordane, \*Tissue analysis, \*Heptachlor.

During gas chromatographic analysis of goby-fish for pesticide residue an unknown peak was noted. The behavior of this compound, identified as trans-nonachlor, under several chemical test is de-scribed. This is the first identification of this compound in environmental biota in Japan. The approximate level of trans-nonachlor in fish examined was 18 ppb as compared to 29 ppb DDE and 670 ppb PCBs. (Deal-EIS)
W80-01087

BIOLOGICAL AVAILABILITY OF SEDIMENT-BOUND CADMIUM TO THE EDIBLE COCKLE, CERASTODERMA EDULE,

Bristol Univ. (England). Dept. of Inorganic Chem-M. Cooke, G. Nickless, R. E. Lawn, and D. J.

Bulletin of Environmental Contamination & Toxicology, Vol 23, p 381-386, 1979. 1 Tab, 13 Ref.

Descriptors: \*Cadmium, \*Absorption, \*Crusta-ceans, Calcium carbonate, Iron, Manganese, Oxides, Chemical properties, Chemical precipita-tion, Heavy metals, Path of pollutants, Spectro-photometry, Zinc, \*Tissue analyais, \*Bioaccumula-tion, \*Bioavailability, \*Cockle, \*Cerastoderma.

The biological availability of cadmium (present as Cd2+) to the edible cockle, Cerastoderma edule, from the four sediments: iron oxide; manganese oxide, calcium carbonate and biogenic calcium car-bonate was investigated. Cadmium bound to biobonate was investigated. Cadmium bound to bio-genic calcium carbonate is readily available to C. edule but cadmium bound to precipitated calcium carbonate is of considerably lower bio-availability. Cadmium bound to iron oxide and manganese oxide is unavailable, at least in short term expo-sures. Availability appears to be determined by the ability of the metal to desorb from the sediment. W80-01088

EXTRACTION AND GAS-LIQUID CHROMA-TOGRAPHIC ANALYSIS OF CHLORPHOXIM IN WATER AND FISH.

Center for Disease Control, Atlanta, GA. Environmental Health Services, Div.

L. H. Zakitis.

Bulletin of Environmental Contamination & Toxicology, Vol 23, p 391-397, 1979. 2 Fig, 2 Tab, 10

Descriptors: \*Analytical techniques, \*Gas chromatography, \*Organophosphorus pesticides, Laboratory tests, Chemical analysis, Chemical reactions, Sunfishes, Pesticide kinetics, Insecticides, Pollutant identification, \*Chlorphoxim, \*Tissue analysis.

Using the basic principle of transesterification by methoxide ion, a gas chromatographic method has been developed for the analysis of chlorphoxim which increases the efficiency of conversion to DEMTP by eliminating undesirable side reactions and thus reducing the time required for GLC analysis to about 3 min. The proposed method has the further advantage of allowing analysis of fish extracts without additional cleanup. To evaluate the effectiveness of the extraction method bluegill fish were exposed to known concentrations of chlorphoxim. Recovery of chlorphoxim from tissue samples averaged 83+ or -15%. The method was also effective in determining levels of chlorphoxim in water. (Deal-EIS) Using the basic principle of transesterification by

AN EVALUATION OF THE ACUTE TOXICITY TO AQUATIC BIOTA OF A COAL CONVERSION EFFLUENT AND ITS MAJOR COMPO-NENTS

NENTS, Oak Ridge National Lab., TN. B. R. Parkhurst, A. S. Bradshaw, J. L. Forte, and G. P. Wright. Bulletin of Environmental Contamination & Toxi-cology, Vol 23, p 349-356, 1979. 4 Tab, 10 Ref.

Descriptors: \*Fuels, \*Toxicity, \*Daphnia, Coals, Organic compounds, Bioassay, Phenols, Ammonia, Sulfates, Nitrates, Phosphates, Chemical waste, Chemical properties, Coal conversion effluent, \*Synthetic fuels, \*Coal conversion, \*Cresols.

This paper describes a systematic evaluation of the potential acute toxicity to aquatic organisms of aqueous wastes from a coal conversion process. Two types of aqueous wastes were analyzed: treat-ed and untreated. The untreated waste had much higher concentrations of phenol, cresols, ammonia, and total organic carbon, while the treated waste had higher concentrations of sulfate, nitrate, phosphate, and thiocyanate. The toxicity (48-h LC50) of each component was determined for Daphia magna. The most toxic components were the cresols followed by phenol, ammonia, and thiocyan-ate. Nitrate, phosphate, and sulfate were relatively nontoxic. (Deal-EIS) W80-01090

EFFECTS OF CHRONIC EXPOSURE TO ZINC ON REPRODUCTION IN THE GUPPY (POE-CILIA RETICULATA), Alberta Univ., Edmonton. (Canada) Dept. of Zoo-

logy. E. J. Uviovo, and D. D. Beatty. Bulletin of Environmental Contamination & Toxi-cology, Vol 23, p 650-657, 1979. 3 Fig, 1 Tab, 30

Descriptors: \*Toxicity, \*Zinc, \*Fish reproduction, Size, Growth stages, Fish physiology, Mode of action, Bioindicators, Heavy metals, Mortality, Fecundity, Zooplankton, \*Guppy, \*Poecilia.

The investigation was undertaken to examine the effects of chronic exposure to sublethal levels of zinc on reproduction in the guppy, Poecilia reticulata. Fish were exposed to either 0.36, 0.88, or 1.70 sata. This were exposed to entire 0.50, 50, 60, 11.70 microg/L zinc for four months. Reproductive data collected included brood size, time between broods, and the size and condition of young at birth. Zinc had no effect on the interval between broods. Brood size was decreased 24, 58 and 50%, respectively, at the three zinc concentrations. In all zinc concentrations, dead young were produced, a condition not observed in controls. Live young in condition not observed in controls. Every young in the two larger zinc exposure groups were signifi-cantly smaller than control or the low-exposure group. The results indicated that these parameters are very sensitive indicators of zinc. (Deal-EIS) W80-01091

BENZO(A)PYRENE CONCENTRATIONS IN MUSSELS (MYTILUS EDULIS) FROM YA-QUINA BAY, OREGON DURING JUNE 1976-Oregon State Univ., Corvallis. Dept. of General

M. C. Mix, and R. L. Schaffer.

Bulletin of Environmental Contamination & Toxicology, Vol 23, p 677-684, 1979. 3 Fig, 1 Tab, 15

Descriptors: \*Aromatic compounds, \*Mussels, \*Absorption, Oil, Oil pollution, Organic compounds, Bioindicators, Monitoring, Chemical analysis, Path of pollutants, Animal physiology, Creosote, Seasonal, Yaguina Bay, Oregon, \*Benzo(a)pyrene, \*Tissue analysis, \*Bioaccumula-

The purposes of this study were to measure benzo(a)pyrene (BAP) concentrations in indigenous populations of mussels for a two-year period, determine seasonal fluctuations in BAP body burdens, and analyze factors that may influence temporal concentration patterns. Mussels ence temporal concentration patterns. Mussels were collected bimonthly from 13 sites. BAP con-

centrations varied considerably in mussels from different geographical sites and during different times of the year. There were general seasonal differences in BAP body burdens that may have been associated with increases in environmental BAP, intrinsic physiological factors and/or the effects of exogenous factors on polynuclear aromatic hydrocarbon uptake and incorporation. Although the sources of BAP are not yet known, it is felt that; point sources such as created rilling. felt that point sources such as creosoted pilings, marinas, fish processing factories and boat traffic, contributed. (Deal-EIS) W80-01092

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PCB RESIDUES IN BIVALVES AND SEDI-MENTS OF RARITAN BAY, Industrial Environmental Research Lab.-Cincin-nati, Edison, NJ.

natt, Edison, NJ.

D. Stainken, and J. Rollwagen.

Bulletin of Environmental Contamination & Toxicology, Vol 23, p 690-697, 1979. 4 Fig, 1 Tab, 12

Descriptors: \*Polychlorinated biphenyls, \*Aroclors, \*Pesticide residues, Oysters, Clams, Shell-fish, Chemical analysis, Bottom sediments, Path of pollutants, DDE, Mollusks, Gas chromatography, Chlorinated hydrocarbons pesticides, Benthic fauna, Hudson River, Raritan Bay, \*Tissue analysis, \*Bioaccumulation.

This study reports the results of a survey of PCB contamination in the Raritan Bay-Lower New York Bay complex. Sediments and bivalve popula-York Bay complex. Sediments and bivalve populations were analyzed to determine quantities and types of PCB compounds present. The range of residues in all bivalve tissues was found to be 12-360 ng/g tissue. The mean values found per species sampled were C. virginica 81 + or -32 ng/g tissue, M. arenaria 139 + or - 27 ng/g tissue and M. mercenaria 131 + or - 27 ng/g tissue. In contrast, the range of residues in sediments was 3.4-2035 ng/g Very few sediment retention times matched. g. Very few sediment retention times matched more than 70% with the standard mix of Aroclors. However, many sediments matched more than 50% with the individual Aroclors. The sediments appear to contain mixtures of various homologs of the Aroclors. Mixtures of Aroclors 1016 and 1242 appeared to occur in all sediments, Aroclor 1260 occurred frequently and 1254 less often. (Deal-EIS) W80-01093

EFFECTS OF ALUMINUM AND NICKEL ON SURVIVAL AND REPRODUCTION IN POLY-CHAETOUS ANNELIDS, California State Univ., Long Beach. Dept. of Biol-

ogy.
S. M. Petrich, and D. J. Reish.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 698-702, 1979. 2 Tab, 21 Ref.

Descriptors: \*Nickel, \*Aluminum, \*Toxicity, \*Polychaetes, Reproduction, Inhibition, Bioassay, Metals, Animal physiology, Mode of action, Chlorides, Chemical wastes, \*Neanthes, \*Capitella, \*Ctenodrilus

The purpose of this investigation was to determine the acute effects of the chlorides of aluminum and nickel on the survival of three species of poly-chaetes and, in addition, to observe any effects on chaetes and, in addition, to observe any effects on reproduction in one species having a short life history. The 96-h and 7-day LC 50 values for aluminum chloride and nickel chloride were determined for Capitella capitata; Ctenodrilus serratus; and Neanthes arenaceodentata. Capitella was the most tolerant of the three species and Ctenodrilus the most sensitive to these two metals. No reproductive suppression was produced in Capitella and Neanthes at maximum possible concentrations (2 mg/L). The results indicated that aluminum is more toxic than nickel to these polychaetes, but the concentration at which reproductive suppression occurs in Ctenodrilus is similar in both metals. (Deal-EIS) (Deal-EIS)

TOXICITY OF SODIUM PENTACHLORO-PHENATE TO JUVENILE CHINOOK

Identification Of Pollutants-Group 5A

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CHLORO-CHINOOK

DADING DENSITY AND CONTINUOUS-FLOW EXPOSURE, British Columbia Dept. of Recreation and Conser-vation, Victoria. Fish and Wildlife Branch. G. K. Iwama, and G. L. Greer. Bulletin of Environmental Contamination & Toxi-cology, Vol 23, p 711-716, 1979. 1 Fig. 11 Ref.

Descriptors: \*Sodium compounds, \*Toxicity, \*Chinook salmon, Juvenile growth stage, Bioassay, Salmonids, Organic compounds, Fish physiology, Mortality, Analytical techniques, Bioassay, \*Sodium pentachlorophenate.

This study reports the results of a bioassay to determine the flow-through 96h LC50 of sodium pentachlorophenate for juvenile chinook salmon at a specified loading density. The incipient 96 h LC50 of NaPCP for juvenile chinook salmon at a loading density of 13.8 g/l was 0.078 mg/l; the 95% confidence limits were 0.057 and 0.110 mg/l. The control fish appeared normal during the 2 weeks of acclimatization to the test tanks and throughout the bioassay period. The NaPCP 96 h LC50 obtained in this continuous-flow bioassay lies in the mid-range of 96 h LC50 values determined for related species of juvenile salmonids by static method in an interlaboratory bioassay standardization study. (Deal-EIS)

HATCHING SUCCESS AND LARVAL MORTALITY IN AN ESTUARINE TELEOST, MENIDIA MENIDIA (LINNAEUS), EXPOSED TO CADMIUM IN CONSTANT AND FLUCTUATING SALINITY REGIMES, Environmental Research Lab., Narragansett, RI. R. A. Voyer, J. F. Heltsche, and R. A. Kraus. Bulletin of Environmental Contamination & Toxicology, Vol 23, p 475-781, 1979. 2 Fig, 2 Tab, 8 Ref.

Descriptors: \*Cadmium, \*Salinity, \*Toxicity, \*Fish eggs, Salt tolerance, Heavy metals, Fish reproduction, Fish physiology, Mortality, Water chemistry, Growth stages, \*Menidia.

In view of cyclic fluctuations in salinity that may accompany tidal changes in an estuary, it was decided to determine the influence of a periodic, fluctuating salinity regime on the hatching success of Menidia embryos exposed to cadmium and on the survival of resulting larvae and to compare these responses with those of embryos and larvae exposed to cadmium at a number of fixed salinities. Menidia were exposed to three levels of cadmium (plus control) at one fluctuating (10-30 o/oo) and three stable (10, 20, 30 o/oo) salinities. Percentage of larval mortality at the constant salinities was higher among larvae from cadmium-exposed eggs than in control treatments, and was consistently greatest at 10 o/oo and least at 30 o/oo salinity. Mean concentrations of cadmium lethal to 50% of the larvae from cadmium-exposed eggs in the two experiments were 0.15, 0.63, and 1.12 mg/l at salinities of 10, 20, and 30 o/oo, respectively. Mean total hatches in cadmium-treated eggs in the fluctuation and the contraction of the support of the fluctuation of the support of the support of the fluctuation of the support total hatches in cadmium-treated eggs in the fluctu-ating salinity regime averaged at least 90% in each of the two low metal concentrations and was about 70% at the high cadmium concentration. (Deal-EIS) W80-01096

EFFECT OF BARITE ON MEIOFAUNA IN A FLOW-THROUGH EXPERIMENTAL SYSTEM, F. R. Cantelmo, M. E. Tagatz, and K. R. Rao. Marine Environmental Research, Vol 2, p 301-309, 1979. 3 Tab, 37 Ref.

Descriptors: \*Bioassay, \*Drilling fluids, \*Mud, Bottom sediments, Benthic fauna, Dominant organisms, Biological communities, Biomass, Depth, Rotifers, Polychaetes, Copepods, Nematodes, Barium sulfate, \*Barite, \*Foraminifera, \*Hydrozoa, \*Turbellaria, \*Ostracoda.

The effects of barite (94-96% BaS04), a major constituent of drilling muds used in marine oil drilling operations, on meiofauna were studied in

an experimental flow-through system. Aquaria containing sand or varying proportions of barite and sand received a continuous supply of unfiltered seawater from Santa Rosa Sound, Florida, for ten weeks. At the end of this period the composition, biomass and vertical distribution of the meiofauna (>>99%) occurred in the highly aerobic upper 2 cm portion of the substratum. Rotifera, Foraminifera, Hydrozoa, Turbellaria, Ostracoda, Polychaeta and Bivalvia did not exhibit significant differences between control and experimental aquaria. However, the densities of Nematoda, Copepoda and Copepoda nauplii varied with the substrate composition. The meiofaunal densities in the aquaria containing 1:10 or 1:3 mixtures of barite and sand were greater than that in aquaria containing sand alone. A marked decrease in meiofaunal density was evident in aquaria containing 5.5 cm of sand covered with a 0.5 cm layer of barite. (Deal-EIS) W80-01097

SUBLETHAL EFFECTS OF HEAVY METAL CONTAMINATED SEDIMENTS ON THE BIVALVE MACOMA BALTHICA (L.),

British Columbia Univ., Vancouver. Inst. of Oceanography. E. R. McGreer.

Marine Pollution Bulletin, Vol 10, p 259-262, 1979. 1 Fig, 4 Tab, 14 Ref.

Descriptors: \*Toxicity, \*Heavy metals, \*Clams, Marine benthos, Mercury, Cadmium, Animal behavior, Animal physiology, Mode of action, Bioindicators, Bioassay, Benthic fauna, Bottom sediments, Methodology, \*Macoma.

Sublethal effects of estuarine sediments containing high levels of heavy metals were studied using the marine bivalve, Macoma balthica. Burrowing behaviour was inhibited in all contaminated sediments compared to the control. The time required for 50% of the population to burrow (ET50) ranged from 0.17h in the control to 4.8h in the most contaminated substrate. A comparison of linear regressions of the concentrations of individual metals in the sediments vs the burrowing response times showed the regressions for mercury and cadmium to be significant. An active threshold avoidance response by burrowed M. balthica was also demonstrated as clams showed a significant avoidance of the sediment containing the highest metal levels. Both behavioural responses were considered useful sublethal tests to assess the impact of sidered useful sublethal tests to assess the impact of polluted sediments. (Deal-EIS) W80-01098

MONITORING TRACE ELEMENTS IN THE MUSSEL, MYTILUS EDULIS USING X-RAY ENERGY SPECTROSCOPY,

Simon Fraser Univ., Burnaby (British Columbia). Dept. of Chemistry.

I. G. Stump, J. Kearney, J. M. D'Auria, and J. D. Popham.

Marine Pollution Bulletin, Vol 10, p 270-274, 1979. 4 Fig, 2 Tab, 21 Ref.

Descriptors: \*Analytical techniques, \*Trace elements, \*X-Ray spectroscopy, Monitoring, Methodology, Chemical analysis, Mussels, Pollutant identification, Heavy metals, Path of pollutants, Manganese, Iron, Copper, Zinc, \*Bioaccumulation, \*Tissue analysis, Arsenic, Selenium, Lead.

X-ray energy spectroscopy has been successfully utilized to provide rapid, multi-elemental, quantitative analyses of the intertidal mussel, Mytilus edulis, found in southern coastal waters of British Columbia (Canada). Since no a priori decision needed to be made on which elements required monitoring, concentrations of the seven dominant elements (Mn, Fe, Cu, Zn, As, Se, and Pb) were determined in the gills and viscera of these organisms. The potential usefulness of XES for providing relevant data on aquatic bioaccumulators for environmental monitoring studies is discussed. (Deal-EIS) W80-01100

THE EMBRYONIC DEVELOPMENT AND THE THERMAL EFFECTS ON THE DEVELOPMENT OF THE MOUNTAIN WHITEFISH, PROSOPIUM WILLIAMSONI (GIRARD), PRUSOPIUM WILLIAMSONI (GIRARD), Utsh Cooperative Fishery Unit, Logan. P. K. Rajagopal. J. K. Rajagopal. J. J. Tables of the Biology, Vol 15, p 153-158, 1979. 1 Fig. 1 Tab, 3 pl, 14 Ref.

Descriptors: \*Growth rates, \*Toxicity, \*Water temperature, Embryonic growth stage, Growth stages, Mortality, Fish physiology, Fish reproduction, Adaptation, Larval growth stage, Thermal stress, Fish diseases, Animal pathology, \*Whitefish, \*Prosopium.

The general development of the mountain white-fish was similar to other whitefishes. Mountain whitefish required more thermal units to reach corresponding stages of the lake whitefish, after the stage when the blastodisc was prominently raised on the yolk. The development process was greatly disrupted and a heavy mortality of egs occurred when the temperature was raised to 9C or higher. In hatched larvae abnormalities like monomicrophthalmia, gape jaws, and coloboma occurred when the temperature was raised to 9C or higher, although the reported optimum temperature for growth of the post yolk sac larvae and juveniles was 9C-12C. The late spawned eggs exhibit adaptive mechanisms which enabled them to shorten the incubation time and hatch along with the early spawned eggs, when conditions for survival are at optimum. (Deal-EIS)

UPTAKE OF METHOXYCHLOR FROM FOOD AND WATER BY THE AMERICAN TOAD (BUFO AMERICANUS), Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center. R. J. Hall, and D. Swineford. Bulletin of Environmental Contamination & Toxi-cology, Vol 23, p 335-337, 1979. 1 Tab, 9 Ref.

Descriptors: \*Absorption, \*Chlorinated hydrocar-bon pesticides, \*Toads, Amphibians, DDT, Pesti-cide kinetics, Path of pollutants, Pesticide residues, Chemical analysis, Gas chromatography, Animal physiology, Animal met

Four groups of toads were maintained in the laboratory: two receiving methoxychlor in food (0.024 or 0.325 ppm); one in water (0.069 ppm); and one control. Toads fed 0.024 ppm methoxychlor in the diet accumulated residues averaging 0.010 ppm. Animals on the dietary dosage for one and six days showed no significant differences in accumulation. All toads fed 0.32 ppm prey had detectable residues; the mean was 0.033 ppm. Tissue levels averaged about 0.4 times the dietary level in the lower dosage groups and 0.11 times dietary concentrations in the higher dosage group. No residues were detected in the controls. Toads exposed to methoxychlor in water had mean residue in levels of 0.192 ppm or approximately 2.8 times the concentration measured in the water. Residue levels are not correlated with duration of exposure. No gross signs of pathology were seen during autopaies, nor signs of pathology were seen during autopsies, nor were there changes in organ weights, feeding, behavior, or survival. (Deal-EIS) W80-01102

TOTAL AND ORGANIC MERCURY IN MARINE FISH OF THE UPPER GULF OF THAILAND, Chulalongkorn Univ., Bangkok (Thailand). Inst. of

Environmental Research.

V. Cheevaparanapivat, and P. Menasveta.

Bulletin of Environmental Contamination & Toxicology, Vol 23, p 291-299, 1979. 4 Fig. 1 Tab, 14

Descriptors: "Mercury, "Trophic level, "Path of pollutants, Heavy metals, Crustaceans, Plankton, Marine fish, Food chains, Spectrophotometry, Chemical analysis, Weight, "Methylmercury, "Tissue analysis, "Bioaccumulation, "Thailand.

One hundred and ninety-one samples of 22 species of fish, 27 samples of 2 species of crustacean and 10

### Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A-Identification Of Pollutants

samples of plankton from the upper Gulf of Thai-land were analysed for total and organic mercury. Total mercury concentrations were found ranging from 2 to 650 ppb with the mean value of 41 ppb. Organic mercury ranged from 0 to 280 ppb with the mean value of 23 ppb. Fish of higher trophic levels contained higher mercury residues than fish of lower trophic levels, which in turn had higher residue levels than the crustaceans and plankton. This suggests that mercury may be concentrated in the same manner as an organic compound such as the organochlorine pesticides. (Deal-EIS) W80-01105

CHARACTERISTICS OF SPORT FISHING AC-

TIVITY IN THREE WARM WATER DIS-CHARGES, Tennessee Valley Authority, Norris. Div. of For-estry, Fisheries, and Wildlife Development. R. W. Schneider, A. O. Smith, and V. P. Mitchell,

Proceedings of the Thirty First Annual Conference of South-East Fish & Wildlife Agencies, Vol 31, p 546-554, 1977. 5 Fig. 1 Tab, 13 Ref.

Descriptors: Water temperature, \*Thermal power plants, \*Thermal water, Water pollution effects, \*Sport fishing, Wastewater disposal, Tennessee, Tennessee Valley Authority, Gallatin steam plant, Remessee Valley Authority, Gallatin steam plant, Kingston steam plant, John Sevier steam plant, Cumberland River, Holston River, Clinch River, Fossil fuels, Sport fishing activity, Monitoring, Fish behavior, Channel catfish, Sunfish, Bass.

Creel surveys were conducted at TVA's Gallatin, Kingston, and John Sevier Steam Plant discharge basins from March 1975 through May 1976. The basins from March 1975 through May 1976. The highest period of angler use at all plants occurred between April and June. Peak harvest and pressure in the 3 discharge basins were significantly related, and high periods usually occurred later in the year than has been reported from other areas. At least 18 species were found in the combined creel from 18 species were found in the combined creel from the 3 plants, and species diversity was greatest during the warm months. Three species, channel catfish (Ictalurus punctatus) bluegill (Lepomis macrochirus), and white bass (Morone chrysops), comprised over 50% of the combined creel. Angler harvest remained uncommonly high from March through August with lowest levels observed in the winter months. The overall angler catch per hour (c/h) was 0.5 fish while the highest monthly c/h recorded was 2.3 at John Sevier in May 1975. It seemed that angler c/h reflected seasonal changes in the sport fish population, and it was concluded that the fishery could sustain a significant increase in pressure and harvest at cersignificant increase in pressure and harvest at cer-tain times of the year. (Deal-EIS) W80-01106

EFFECTS OF COREXIT 9527 ON THE HATCH-ABILITY OF MALLARD EGGS, Fish and Wildlife Service, Laurel MD. Patuxent

Wildlife Research Center.

P. H. Albers. Bulletin of Environmental Contamination & Toxicology, Vol 23, p 661-668, 1979. 3 Tab, 23 Ref.

Descriptors: \*Oil, \*Toxicity, \*Mallard duck, \*Bird eggs, Hatching, Mortality, Oil spills, Oil pollution, Waterfowl, Chemical properties, Animal physiology, Growth stages, Embryonic growth stage, \*Crude oil, \*Dispersants, \*Corexit 9527.

The paper reports the results of a study of the effects of Corexit 9527 dispersant, crude oil, and crude oil/Corexit 9527 mixtures on mallard duck (Anas platyrhynchos) embryos. Groups of eggs were treated with either 1, 5, or 20 ul of Prudhoe Bay (Alaska) crude oil, Corexit 9527, a 30:1 oil/Corexit mixture. Mallard eggs treated with 20 ul of crude oil, Corexit 9527, 30:1 oil/Corexit 9527, 30:1 oil/Corexit 9527, and 5 ul offerent 9527 and 5 ul offerent 9527 and 5 ul offerent 9527. and 5 ul Corexit 9527 and 5:1 oil/Corexit 9527 had significantly lower hatching success than the untreated control eggs. The comparisons between treated groups and the control and among treated groups were used to create a general toxicity ranking; (Corexit 9527 > [1 oil/Corexit 9527) > ranking; (Corexit 9527) > Corexit 9527 appeared to penetrate egg shells and shell

membranes as readily as crude oil. No gross external malformations or behavioral abnormalities were observed. (Deal-EIS)

SOME EFFECTS OF CERTAIN METALS ON DEVELOPMENT AND MORTALITY WITHIN THE MOULT CYCLE OF CRANGON THE MOULT CRANGON(L.),

Hull, Univ. (England). Dept. of Zoology.
R. K. J. Price, and R. F. Uglow.
Marine Environmental Research, Vol 2, p 287-299, 1979. 4 Fig. 4 Tab, 32 Ref.

Descriptors: \*Shrimp, \*Mortality, \*Heavy metals, \*Growth stages, \*Cadmium, \*Copper, \*Zinc, Size, Animal behavior, Animal physiology, Toxicity, \*Crangon, Moulting.

Crangon crangon were subjected to three metals (Cd, Cu and Zn) at respective concentrations (0.35, 1.6 and 14.4 mg/litre) that would induce 50% mortality in 5-6 days. Significantly different rates of mortality occurred in the three groups, although their ET50's were almost identical. No moulttheir ET50's were almost identical. No moult-stage-dependent mortality was observed for Cd, but in Cu and Zn in the post-moult-stages were more susceptible than either the intermoult or pre-moult stage. No significant sex- or size-dependent mortality was evident at the tested concentrations of these metals. Feeding and edvelopment from one moult-stage to the next was greatly reduced in Cd. Possible modes of toxicity have been discussed in terms of the physiological condition inferred from the moult-stage at the time of death. (Deal-EIS) W80-01108

MULTIPLE REGRESSION MODELING AP-PROACH FOR REGIONAL WATER QUALITY MANAGEMENT,

Geological Survey, Portland, OR. D. J. Lystrom, F. A. Rinella, D. A. Rickert, and L.

Zimmerman.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 319, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/7-78-198, October 1978, 59 p. 9 Fig, 4 Tab, 78 Ref, 4 Append. EPA-IAG-D5-0982.

Descriptors: \*Statistical models, \*Water quality, \*Regional analysis, \*Watersheds(Basins), \*Susque-Descriptors: "Statistical models, "Water quality, "Regional analysis, "Watersheds(Basins), "Susquehanna River, Model studies, Statistics, Mathematical models, Regression analysis, Equations, Nunerical analysis, Water pollution sources, Regions, Pennsylvania, New York, Basins, Land use, Watershed management, Planning, Sediment transport, Nonpoint pollution, Soil properties.

Multiple-regression analysis was specifically structured to define basin characteristics controlling nonpoint pollution sources by assessing regional water quality variations in the Susquehana River basin in Pennsylvania and New York. The developed multiple-regression models are applicable only to the Susquehanna River and to hydrologically similar basins; however, the general approach is potentially applicable to other regions. Water quality is defined by four major properties: suspended sediment, dissolved solids, nitrogen, and phosphorus. These properties were selected be-cause of their response to development in rural areas. These properties are expanded into 17 char-acteristics and are experimentally related to 57 other basin characteristics. Six general basin characteristics groups are: climate, geology, topography, soils, streamflow, and land use. Multiple-linear-regression equations relate water quality (deinnear-regression equations reiate water quairy (de-pendent variables) to basin characteristics (inde-pendent variables). Multiple-regression models ex-plain 56% to 89% of water quality characteristics variations, standard errors range from 17% to 75%. These models can estimate water quality at respectific stream sites or simulate generalized land use effects on water quality. For example, observed nitrate yields are 20 times greater than simulated background yields; the increase indicates chemical fertilizer, animal waste, and urbanization impacts. (Danovich-Wisconsin) W80-01118

EVIDENCE OF ARGO MERCHANT CARGO OIL IN MARINE BIOTA BY GLASS CAPIL-LARY GC ANALYSIS,

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NOAA National Analytical Facility, Seattle, WA. W. D. MacLeod Jr. L. C. Thomas, M. Y. Uyeda. and R. G. Jenkins.

and K. G. Jenkins. In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 138-151, 8 Fig, 16 Ref.

Descriptors: \*Oil spills, \*Analytical techniques, \*Pollutant identification, \*Water pollution, \*Fish, Sediments, Gas chromatography, Massachusetts, Weathering, \*Outer continental shelf, Hydrocarbons, Pattern matching.

bons, Pattern matching.

Thirty-seven samples of marine biota collected in response to the Argo Merchant oil spill were analyzed for hydrocarbons by glass capillary gas chromatography (GC). Rapid, temperature programmed analysis of hydrocarbons from n-C10H22 to n-C34H70 was demonstrated on a 2-m glass capillary. Analysis time was 7 minutes vs. 40 minutes or more on a 2-m packed column of comparable resolution. Finely detailed high resolution gas chromatograms were obtained on 20-m glass capilaries. The GC patterns of the saturated hydrocarbons extracted from marine biota were visually compared with the corresponding GC pattern from the Argo Merchant cargo. The stomach contents from two cod samples and one windowpane flounder sample afforded finely detailed gas chromatograms of saturated hydrocarbons that compared well with the cargo chromatogram. Analogous comparisons of the aromatic hydrocarbons confirmed the correlation for only one of the samples from cod. (Sinha - OEIS) ples from cod. (Sinha - OEIS) W80-01144

FATE AND EFFECT OF BUNKER C OIL SPILLED BY THE USNS POTOMAC IN MELVILLE BAY - GREENLAND - 1977,

Greenland Fisheries Investigations, Charlottenlund For primary bibliographic entry see Field 5C. W80-01148

THE EKOFISK BRAVO BLOWOUT, PETRO-LEUM HYDROCARBONS IN THE SEA, Institute of Marine Research, Bergen (Norway). For primary bibliographic entry see Field 5C. W80-01154

PRESENCE AND SOURCES OF OIL IN THE SEDIMENT AND BENTHIC COMMUNITY SURROUNDING THE EKOFISK FIELD AFTER THE BLOWOUT AT BRAVO, Nalco Environmental Sciences, Northbrook, IL.;

and Masspec Analytical Speciality Services Ltd., Stroud (England).

For primary bibliographic entry see Field 5C. W80-01155

INTERLABORATORY QUALITY CONTROL STUDY NO 19 TOTAL MERCURY IN WATER, LOW-LEVEL CONCENTRATIONS, Canada Centre for Inland Water, Burlington (On-

K. I. Aspila, and J. M. Carron. Report Series No 62, 1979. 23 p, 5 Fig, 4 Tab, 8 Ref. 2 Append.

Descriptors: \*Mercury, \*Water quality, \*Water quality control, \*Water analysis, Laboratory tests, Sampling, Concentrations.

Results of an interlaboratory comparison of ten test samples containing mercury between 0.00 and 0.56 micro g per L are described. Twenty-seven Canadian laboratories participated. Test samples (100 mL) were preserved with 1 percent (v per v) H2SO4 plus 0.05 percent (w per v) K2Cr207 and distributed in Pyrex glass bottles with Teflon inserts. Because of breakages some participants received additional solutions contained in linear polyethylene bottles. Data were evaluated by the rejection of results greater than two standard devition of results greater than two standard devi-

Sources Of Pollution—Group 5B

ations from the mean. Using this adjusted data set, precision functions were developed to describe the interlaboratory standard deviations as a function of concentration. Within-run and between-run precision functions for in-laboratory analyses are also described. A number of laboratories have demonstrated in the control of the contro strated that they have significant potential with respect to monitoring mercury in natural samples in the critical environmental range from 0.02 micro g per L to 0.20 micro g per L Hg. (WATDOC) W80-01171

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ENVIRONMENTAL IMPROVEMENT AT NER-OUTSOS INLET, B. C. VOLUME 1 SUMMARY REPORT, | Rayonier Canada (B.C.) Ltd., Port Alice. R. Tollefson, and E. Tokar. Rayonier Canada (B.C.) Limited, December, 1978, 55 p, 17 Fig, 2 Tab, 10 Ref.

Descriptors: \*Pulp & paper industry, \*Pulp wastes, Water quality, Primary productivity, Benthos, \*Salmon, Toxicity bioassay, Fish behavior, Fish populations, Fish repelling, Estuaries, \*Vancouver Island, Neroutsos Inlet, Water pollution effects, Path of pollutants, Waste water disposal, Primary productivity.

A sulfite pulp mill has been in operation since 1917 at Port Alice, B.C. Until recently, its effluents have been discharged essentially untreated into the adjacent waters of Neroutsos Inlet. In 1978 Rayonier instituted an extensive environmental impact study of the Neroutsos Inlet area, involving both Provincial and Federal governmental agencies, academic and private consultant groups, as well as the company's personnel. This series of reports presents the 1978 results of these investigations covering water quality, primary productivity, benthic organisms, salmonid migrants, and toxicity studies of the effluent, in an effort to assess the overall quality of the environment, the benefits of the abatement program to date, and possible further abatement needs. The results to date show a pronounced improvement in the physical and chemical aspects of water quality. Limited local effects are still seen, however, in the immediate mill area. Salmonid populations appear to be within normal ranges for unpolluted waters and there is evidence of increases in certain other biological forms. However, in view of the observed variations in the populations, further study is recommended to better define and evaluate the controlling factors behind these variations. No environmental condition observed in 1978 is critical. (Detz-EIS)

ENVIRONMENTAL IMPROVEMENT AT NER-OUTSOS INLET, B.C. VOLUME 5 MIGRA-TORY STUDIES OF JUVENILE SALMONIDS IN UPPER NEROUTSOS INLET, 1978, Beak Consultants Ltd., Vancouver (British Colum-hia)

V. A. Poulin, and G. E. Roseberg. Rayonier Canada, Port Alice, British Columbia, Dec., 1978, 56 p, 16 Fig, 5 Tab, 22 Ref, 19 Append.

Descriptors: \*Salmon, \*Fish migration, Estuaries, \*Pulp & paper industry, \*Pulping wastes, Monitoring, Water quality, Hydrogen ion concentration, Ammonium compounds, Neroutsos Inlet, Vancouver Island, Water pollution effects, Fish behavior, Fish food organisms, Industrial wastes, On-site-investigation, Port Alice, Seaward migration, Growth.

Fisheries studies were conducted from 17 March to 22 June, 1978, to describe the timing, relative abundance and migratory pathways of juvenile chum salmon (Oncorhynchus keta) in the upper headwaters of Neroutsos Inlet, Vancouver Island. Treated wastes from a pulp mill were discharged into the inlet at Port Alice. Catch results obtained by beach seine, surface trawl and fyke net indicated the downstream migration to inlet waters began in late February and seaward migration concluded in early June. After entering Neroutsos Inlet juvenile chum salmon dispersed in offshore inlet waters and along the eastern and western shorelines of the narrow waterbody. In the vicinity of Port Alice east side migrants were absent from nearshore

areas and did not reappear until some 2.0 to 2.5 km down-inlet. Juvenile chum captures revealed that seaward migration peaked in mid to late April. In early May migrant numbers showed a decline and by the end of the month most juveniles had passed seaward of the Frigon Islets. (Katz-EIS) W80-01195

EMBRYO-LARVAL TOXICITY TESTS WITH ORGANIC COMPOUNDS,
Thomas Hunt Morgan School of Biological Sciences, Lexington, KY.
W. J. Birge, J. A. Black, J. E. Hudson, and D. M.

Bruser.
In: Aquatic Toxicology, ASTM STP 667, L. L.
Marking and R. A. Kimerle, Eds, American Society for Testing and Materials, p 131-147, 1979. 4
Fig. 5 Tab, 21 Ref. OWRT A-074-KY(1).

Descriptors: \*Bioassay, \*Organic compounds, \*Toxicity, Methodology, Laboratory tests, Analytical techniques, Bass, Channel caffish, Rainbow trout, Phenols, Fish eggs, Embryonic growth stage, Larval growth stage, Fish physiology, \*Aniline, \*Chlorobenzene, \*Teratogens.

stage, Larval growth stage, Fish physiology, \*Aniline, \*Chlorobenzene, \*Teratogens.

A continuous-flow system was developed for evaluating the effects of insoluble and volatile organics on the developmental stages of fish. A closed test system, devoid of standing air space, was used to minimize volatility as a variable. Insoluble compounds were suspended in influent water by mechanical homogenization, without the use of carrier solvents. Tests were performed with aniline, chlorobenzene, and phenol. Water hardness was maintained at 50 and 200 mg/litre calcium carbonate, and exposure was continuous from fertilization through four to eight days after hatching for largemouth bass, channel catfish, goldfish, and rainbow trout. The results indicated that there was good reproducibility of exposure concentrations down to 1 microg/litre or less. When phenol was administered in hard water, the LC1 and LC30 values determined at hatching were 0.2 and 30 microg/litre for trout, and 2.0 and 710 microg/litre for frout, and 2.0 and 710 microg/litre for trout, and 2.0 and 710 microg/litre. The aniline LC50 values calculated for catfish, goldfish, and bass eggs were exposed through four days after hatching, the LC50s for chlorobenzene ranged from 50 to 60 microg/litre. The aniline LC50 values calculated for catfish, goldfish, and bass eggs treated in soft water were 5.6, 10.2 and 47.3 mg/litre, respectively. Because of the differential rates of larval mortality for the three species, the LC30 range narrowed considerably when the exposure time was increased beyond hatching. Water hardness exerted no appreciable effects on the toxicity of either chlorobenzene or aniline. All three organic compounds produced significant frequencies of teratic larvae. (Deal-EIS)

HIERARCHICAL DIVERSITY OF COMMUNITIES OF AQUATIC INSECTS AND FISHES, Kansas Univ., Lawrence. Dept. of Geology. R. L. Kaesler, and E. E. Herricks. Water Resources Bulletin, Vol 15, No 4, p 1117-1125, 1979. 1 Fig, 9 Tab, 7 Ref. OWRT C-6007

Descriptors: \*Biological communities, \*Sampling, \*Bioindicators, \*Analytical techniques, Mathematical studies, Fish populations, Monitoring, Aquatic insects, Data collections, Ecology, Statistical analysis, Mathematical models, \*Diversity, \*Species diversity.

Hierarchical diversity analysis of data on fish and aquatic insects showed that the component of diversity contributed by the species level was generally very small compared with the component at the generic level or with the total diversity. Very high rank correlations between generic diversity in which genera were discriminated but not identiin which genera were discriminated but not identi-fied, and species diversity suggested that the pur-poses of environmental monitoring might best be served by working at the generic level rather than the species level. This is particularly true when an index of diversity is to be used as the major com-parative and communicative tool. The savings of time and money could be appreciable. (Deal-EIS)

W80-01198 5B. Sources Of Pollution

A RECURRENCE MODEL FOR THE PREDICTION OF DDT FLUX IN ATLANTIC MENHA-

DEN, National Marine Fisheries Service, Beaufort, NC. Beaufort Lab. S. M. Warlen.

S. M. Walten. Proceedings of the Thirty-First Annual Conference Southeastern Association of Fish and Wildlife Agencies, Vol 31, p 425-431, 1977. 3 Fig. 2 Tab, 9 Ref.

Descriptors: \*Atlantic menhaden, \*DDT, \*Mathematical models, Chlorinated hydrocarbon pesticides, Path of pollutants, Animal metabolism, Fish physiology, Fish migrations, Pesticide residues, Ecosystems, Model studies, \*Bioaccumulation.

A simple recurrence model is developed for the prediction of DDT flux through Atlantic menhaden (Brevcortia tyrannus). The DDT body burden in young-of-the-year menhaden at any time is equal to the body burden on the previous day plus the DDT accumulated on the current day minus the DDT turnover. Accumulation of DDT is simulated and compared with field observations. Estimations of DDT ingestion, assimilation, turnover, and egestion are made on both per fish and population bases. It is estimated that emigrating juvenile menhaden export 20 g DDT/year from the Newport River estuary in North Carolina. (Deal-EIS) W80-00806

HEAVY METAL EXCHANGE BY ASCOPHYL-LUM NODOSUM (PHAEOPHYCEAE) PLANTS IN SITU,

m Univ. (Norway). Inst. of Marine Bio-

Chemistry.

S. Myklestad, I. Eide, and S. Melsom.
In: Proceedings of the Ninth International Seaweed Symposium, A. Jensen and J. R. Stein, Eds., Science Press, Princeton, p 143-151, 1977. 4 Tab, 6

Descriptors: \*Phaeophyta, \*Heavy metals, \*Plant physiology, Metabolism, Ion exchange, Plant growth, Growth stages, Absorption, \*Zinc, \*Cadmium, \*Lead, Plant morphology, \*Mercury, Chemical analysis, \*Tissue analysis.

The uptake and loss of heavy metal in Ascophyl-lum nodosum have been studied in the field by exchanging plants between uncontaminated and metal contaminated sites. The tissue synthesized at the new site had a metal composition similar to the newly synthesized tissue in the native plants from the same locality. The different metals showed the same locality. The different metals showed somewhat different patterns regarding the metal exchange process. Some possible mechanisms are discussed in relation to current theories of heavy metal exchange in brown algae. (Deal-EIS) W80-00816

UPTAKE, BIOTRANSFORMATION, DISPOSITION, AND ELIMINATION OF 2-METHYL-NAPHTHALENE AND NAPHTHALENE IN SEVERAL FISH SPECIES, Medical Coll. of Wisconsin, Milwaukee. Dept. of

Pharmacology.
For primary bibliographic entry see Field 5A.
W80-00821

AN ASSESSMENT OF DDT TOXICITY ON OS-MOREGULATION AND GILL NA,K-ATPASE ACTIVITY IN THE BLUE CRAB, Emporia State Univ., KS. Div. of Biological Sci-

For primary bibliographic entry see Field 5A. W80-00822

ACEPHATE AND FENITROTHION TOXICITY IN RAINBOW TROUT: EFFECTS OF TEMPERATURE STRESS AND INVESTIGATIONS ON THE SITE OF ACTION,

#### Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

# Group 5B-Sources Of Pollution

National Inland Fisheries Inst., Bangkok (Thai-For primary bibliographic entry see Field 5A.

EXCRETION OF THE LAMPRICIDE BAYER 73 BY RAINBOW TROUT, Fish and Wildlife Service, La Crosse, WI. Fish

Fish and Wildlife Service, La Crosse, Wi. Fish Control Lab. J. L. Allen, V. K. Dawson, and J. B. Hunn. In: Aquatic Toxicology, ASTM STP 667, L. L. Marking and R. A. Kimerle, Eds, American Soci-ety for Testing and Materials, p 52-61, 1979. 4 Fig, 1 Tab, 13 Ref.

Descriptors: \*Rainbow trout, \*Animal metabolism, \*Pesticide kinetics, Path of pollutants, Fish physiology, Chemical analysis, Ions, Sodium, Potassium, Calcium, Magnesium, Chlorides, Chemical proper-ties, \*Bayer 73, \*Lampricides, \*Tissue analysis.

Urinary excretion of the 2-aminoethanol salt of 2', 5-dichloro-4'-nitro-salicylanilide (Bayer 73) in rainbow trout was measured after exposure of the trout to Bayer 73 and also after intraperitoneal (ip) injection to Bayer 73 and also after intraperitoneal (ip) injection of the lampricide. Fish exposed to 0.05 mg/litre of Bayer 73 for 12 h quickly began to excrete residues in the urine. The largest amount of Bayer 73 was excreted during the 12-h exposure, but the trout continued to excrete Bayer 73 beyond 60 h after exposure. They excreted up to 25% of the dose in the urine, and 20% was recovered glucuronide conjugate. The exposure of rainbow trout to Bayer 73 at the doses studied had no effect on the urine output or on the renal excretion of sodium (Na+), potassium (K+), calcium (Ca2+), magnesium (Mg2+), and chloride (C1-). (Deal-EIS) W80-00824

TAINT THRESHOLD OF DIPHENYL OXIDE

IN RAINBOW TROUT,
Dow Chemical Co., Midland, MI. Environmental
Sciences Research Lab.
For primary bibliographic entry see Field 5A. W80-00978

UPTAKE, DEPURATION, AND TOXICITY OF HEXAMETHYLPHOSPHORAMIDE IN AQUATIC ORGANISMS,

Haskell Lab. for Toxicology and Industrial Medi-cine, Newark, DE. For primary bibliographic entry see Field 5A. W80-00833

CONCENTRATION OF ELEMENTS IN MARINE ORGANISMS CULTURED IN SEAWATER FLOWING THROUGH COAL-FLY

Woods Hole Oceanographic Institution, MA. For primary bibliographic entry see Field 5A. W80-00834

EVIDENCE FOR THE PROTECTIVE EFFECT OF METALLOTHIONEINS AGAINST INOR-GANIC MERCURY INJURIES TO FISH, Liege Univ. (Belgium). Lab. d'Oceanogolie. For primary bibliographic entry see Field 5A. W80-00839

ENVIRONMENTAL BROMINE IN FRESH-WATER AND FRESHWATER ORGANISMS: FACTORS AFFECTING BIOACCUMULATION, Middle Tennessee State Univ., Murfreesboro. Dept. of Chemistry and Physics. For primary bibliographic entry see Field 5A. W80-00840

**IDENTIFICATION OF THE HERBICIDE 2,4,6-**TRICHLOROPHENYL P4-NITROPHENYL ETHER IN IMPORTED RAINBOW TROUT, Food and Drug Administration, Brooklyn, NY. Food and Drug Administration, Brooklyn, For primary bibliographic entry see Field 5A. W80-00841

ACUTE ENDRIN TOXICITY ON OXIDASES OF OPHIOCEPHALUS PUNCTATUS (BLOCH),

Hindu Coll., Moradabad (India). Dept. of Zoo-For primary bibliographic entry see Field 5A. W80-00842

STUDIES ON THE DEPURATION OF CADMI-UM AND COPPER BY THE AMERICAN OYSTER CRASSOSTREA VIRGINICA, Environmental Research Lab., Narragansett, RI.

G. E. Zaroogian.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 117-122, 1979. 1 Fig. 1 Tab, 14 Ref.

Descriptors: "Cadmium, "Copper, "Oysters, Path of pollutants, Heavy metals, Animal physiology, Animal metabolism, Water chemistry, Chemical analysis, Water temperature, Growth rates, "Tissue analysis, "Bioaccumulation, "Depuration.

This study was an attempt to establish under laboratory conditions whether treated ovsters would ratory conditions whether treated oysters would depurate accumulated cadmium and copper when returned to cleaner waters containing natural concentrations of these metals. The oysters were treated with cadmium for 40 weeks. Depuration of cadmium proceeded for 16 weeks following treatment. Since the oysters contained high concentrament. Since the obsters contained might concentra-tions of copper at the time of collection, depura-tion of copper was studied for 56 weeks. Data indicated that cadmium was not depurated by C. virginica under the conditions of this experiment, particularly a declining temperature regime. No significant decrease in copper concentration oc-curred in either the control or cadmium treated oysters with increasing or decreasing temperature regimes. (Deal-EIS) W80-00843

DISTRIBUTION OF RADIOACTIVITY IN COALFISH (POLLACHIUS VIRENS) FOL-LOWING INTRAGASTRIC ADMINISTRATION OF (9-14C) PHENANTHRENE, Bergen Univ. (Norway). Inst. of Fisheries Biology. For primary bibliographic entry see Field 5A. W80-00844

POLLUTANT LEVELS IN THE GREAT SKUA CATHARACTA SKUA.

Durham Univ. (England). Dept. of Zoology. R. Furness, and M. Hutton. Environmental Pollution, Vol 19, p 261-268, 1979. 7 Tab. 22 Ref.

Descriptors: \*Bioindicators, \*Chlorinated hydro-carbon pesticides, \*Water birds, DDT, Polychlorinated biphenyls, DDE, Dieldrin, Heavy metals, Bird eggs, Food habits, Animal physiology, Animal metabolism, Path of pollutants, \*Selenium, \*Bioaccumulation, \*Tissue analysis, \*HCB, \*Skua.

The great skua combines the traits favouring accumulation of pollutants. Levels of PCB and DDE are high, but there is no evidence of egg-shell are high, but there is no evidence to leggestactions of age-accumulation of heavy metals in adult great skuas and renal cadmium levels are very high in some individuals. Selenium concentrations correlate with mercury and cadmium concentrations. Possible protective effects of selenium are discussed. Levels of PCBs, effects of scientum are discussed. Levels of PCBs, DDE, HCB and dieldrin in eggs all correlate with each other, and vary greatly between individuals, suggesting individual variation in excretory rates, feeding habits or distribution in winter. Mercury levels in primary feathers correlate with those in liver so may be used to monitor without killing birds. The feeding habits and migrations of the great skus make it a suitable indicator of offshore pollution in the north-east Atlantic. (Deal-EIS) W80-00845

VARIABILITY OF THE CONCENTRATIONS OF SEVENTEEN TRACE ELEMENTS IN THE MUSCLE AND LIVER OF A SINGLE STRIPED BASS, MORONE SAXATILIS,

Department of Energy, New York. Environmental Measurement Lab. For primary bibliographic entry see Field 5A.

DETERMINATION METHOD FOR RESIDUAL 1,3-DICHLORO-AND 1,3,5-TRICHLORO-2-(4-NITROPHENOXY) BENZENE (NIP AND CNP) IN FISH AND SHELLFISH, Tokyo Metropolitan Research Lab. of Public Tokyo Metropolitan Research Lab. of P Health (Japan). For primary bibliographic entry see Field 5A. W80-00847

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ORGANOCHLORINE RESIDUES IN EGGS OF THE ENDANGERED AMERICAN CROCO-DILE (CROCODYLUS ACUTUS), Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center. For primary bibliographic entry see Field 5A. W80-00848

ABERRATIONS IN THE NEUROSECRETORY ABERRATIONS IN THE NEUROSECRETORY
CELLS OF A FRESHWATER PULMONATE,
INDOPLANORBIS EXUSTUS, CHRONICALLY
EXPOSED TO SUBLETHAL CONCENTRATION OF TWO MOLLUSCICIDES, BACL2
AND CUSO4,
Marathwada Univ., Aurangabad (India). Dept. of Zoology.

For primary bibliographic entry see Field 5A. W80-00849

FATE OF 14C-CIS-CHLORDANE IN GOLD-FISH, CARASSIUS AURATUS (L.), Illinois Univ. at the Medical Center, Chicago. Dept. of Biological Sciences. For primary bibliographic entry see Field 5A. W80-00850

EFFECTS OF IN VIVO CADMIUM EXPOSURE ON ATPASSES IN GILL OF THE LOBSTER, HOMARUS AMERICANUS,

National Marine Fisheries Service, Highlands, NJ. Sandy Hook Sport Fisheries Marine Lab. For primary bibliographic entry see Field 5A. W80-00851

HEXACHLOROBENZENE (HCB) LEVELS IN LAKE ONTARIO SALMONIDS, Canada Centre for Inland Waters Burlington (Ontario). For primary bibliographic entry see Field 5A. W80-00852

ALKANES IN BARNACLES (BALANUS TIN-TINNABULUM) FROM THE BUCCANEER

OILFIELD, Houston Univ., TX. Dept. of Biophysical Scie For primary bibliographic entry see Field 5A. W80-00853

PARATHION CAUSES SECONDARY POISON-ING IN A LAUGHING GULL BREEDING COLONY, Fish and Wildlife Service, Victoria, TX. Gulf Coast Field Station. For primary bibliographic entry see Field 5A. W80-00854

IN VITRO TOXICITY OF EIGHT MUTAGENS/ CARCINOGENS FOR THREE FISH CELL

Washington Univ., Seattle. Dept. of Pathology. For primary bibliographic entry see Field 5A. W80-00855

OCCURRENCE OF PCB RESIDUES IN BURBOT (LOTA LOTA) AND LAKE TROUT (SALVELINUS NAMAYCUSH) FROM THE CHURCHILL FALLS POWER DEVELOPMENT

AREA,
Department of Fisheries and Environment, Halifax
(Nova Scotia).
For primary bibliographic entry see Field 5A.
W80-00856

COMBINED EFFECTS OF TEMPERATURE, SALINITY AND CADMIUM ON DEVELOP-

# Sources Of Pollution-Group 5B

MENT, GROWTH AND MORTALITY OF MY-TILUS EDULIS LARVAE FROM THE WEST-ERN BALTIC SEA, Kiel Univ. (Germany, F.R.). Inst. fuer Mecres-

kunde. W. Lehnberg, and H. Theede.

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Helgolander wissenschaftlichen Meeresuntersuchungen, Vol 32, p 179-199, 1979. 9 Helgolander Fig, 3 Tab, 28 Ref.

Descriptors: \*Cadmium, \*Salinity, \*Water temperature, \*Toxicity, \*Animal growth, Growth rates, Growth stages, Larval growth stage, Mortality, Animal physiology, Animal metabolism, Animal populations, Mussels, \*Mytilus.

The response surface method was used to study the effects of temperature, salinity and Cd contamination on the development of fertilized eggs of Mytilus edulis to the veliger stage as well as on growth and cumulative mortality of a veliger population. The reactions observed differ considerably with reference to temperature and salinity. Cd only with reference to temperature and salinity. Cd only slightly influences various temperature-dependent life functions, but strongly modifies those depending on salinity. The development optimum is shifted to higher salinities with increasing Cd concentrations of the medium, while that of survival and growth is shifted to lower salinities. These factor interactions modify the tolerance limits. In addition, the rates of factor interactions on the larval stages change with the degree of development. The trochophora stage proves to be most sensitive to the factors studied. A significant influence of cadmium on different life functions is found from concentrations of about 50 ppb on. (Deal-EIS) W80-00858

TOXICITY AND TISSUE UPTAKE OF METH-YLMERCURY ADMINISTERED INTRAPERI-TONEALLY TO RAINBOW TROUT (SALMO GAIRDNERI RICHARDSON), Alberta Univ., Edmonton. Dept. of Zoology. For primary bibliographic entry see Field 5A. W80-00859

POLYCHLORINATED BIPHENYLS IN PLANKTON FROM THE TURKU ARCHI-PELAGO,

Turku, Univ. (Finland). Dept. of Chemistry and Biochemistry. For primary bibliographic entry see Field 5A. W80-00861

INFLUENCE OF SALINITY AND CADMIUM ON CAPSULE STRENGTH IN PACIFIC HER-

GRENGER STRENGTH IN PACIFIC HER-RING EGGS, Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station. For primary bibliographic entry see Field 5A. W80-00865

DDT AND ITS METABOLITES IN ANTARCTIC

BIRDS, Warsaw Univ. (Poland). Dept. of Zoology and For primary bibliographic entry see Field 5A. W80-00867 Ecology.

DDT AND ITS METABOLITES IN ANTARCTIC KRILL (EUPHAUSIA SUPERBA DANA) FROM SOUTH ATLANTIC, Warsaw Univ. (Poland). Dept. of Zoology and

Ecology. For primary bibliographic entry see Field 5A. W80-00868

RESULTS OF TESTING LANDSPREADING OF TREATED MUNICIPAL WASTEWATER AT ST. PETERSBURG, FLORIDA, Geological Survey, Tallahassee, FL. Water Re-

sources Div. R. C. Reichenbaugh, D. P. Brown, and C. L.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 730, Price codes: A03 in paper copy, A01 in microfiche.

Geological Survey Water-Resources Investigations 78-110, 1979, 47 p. 10 Fig. 14 Tab. 8 Ref.

Descriptors: \*Water spreading, \*Irrigation effects, \*Waste water disposal, \*Sewage, \*Water pollution effects, Bermudagrass, Soil water movement, Path of pollutants, Soil-water-plant relationships, Tile drains, Water reuse, Infiltration, Water table, Groundwater recharge, Nutrients, Bacteria, Coliforms, Florida, \*St. Petersburg, Secondary-treated common control of the property of

Chlorinated secondary-treated effluent was used to irrigate a grassed 4-acre site at rates of 2 and 4 inches per week for periods of 11 and 14 weeks, respectively. Part of the site was drained by tile lines 5 feet below land surface. Irrigation of the drained plot resulted in rapid passage of the applied wastewater through the soil and, consequently, poor nitrogen removal. The rapid percolation permitted nitrification but prevented denitrification. Total phosphorus in the shallow ground water at the site increased from a maximum of 1.4 milligrams per liter before irrigation to as much as 5 milligrams per liter in the ground water 5 feet below land surface. Concentrations of nitrogen and phosphorus did not increase in ground water downgradient from the site, although increased chloride concentrations demonstrated downgradient migration of the applied wastewater. Prior to dient migration of the applied wastewater. Prior to irrigation, total coliform bacteria were not detection of the applied wasteria were not detection ground water at the site. After irrigation, total and fecal coliforms were detected in the ground water at the site and downgradient. (Woodard-USGS) W80\_00024

QUANTITY AND QUALITY OF URBAN RUNOFF FROM THREE LOCALITIES IN THE DENVER METROPOLITAN AREA, Geological Survey, Lakewood, CO. Water Re-

For primary bibliographic entry see Field 4C. W80-00927

EFFECT ON SEDIMENT YIELD AND WATER QUALITY OF A NONREHABILITATED SUR-FACE MINE IN NORTH-CENTRAL WYO-

Geological Survey, Cheyenne, WY. Water Resources Div., and Geological Survey, Lakewood, CO. Water Resources Div. For primary bibliographic entry see Field 2J. W80-00928

BASELINE WATER QUALITY OF IOWA'S COAL REGION, Geological Survey, Iowa City, IA. Water Resources Div. For primary bibliographic entry see Field 6A.

PESTICIDE RESIDUES IN AGRICULTURAL DRAINS, SOUTHEASTERN DESERT AREA, CALIFORNIA, Geological Survey, Menlo Park, CA. Water Re-

W80-00931

sources Div. L. A. Eccles

L. A. Eccles. Available from the National Technical Information Service, Springfield, VA 22161 PB-300 824/AS, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-16, March 1979. 60 p, 13 Fig, 7 Tab, 4 Ref.

Descriptors: \*Pesticides, \*Agricultural runoff, \*Tile drains, \*Irrigation water, \*California, De-serts, Data collections, Sampling, Chemical analy-sis, \*Pesticide residues, Bed material, Irrigation

A study is being made to determine the occurrence A study is being made to determine the occurrence and distribution of pesticides in the agricultural drains for approximately 3/4 million irrigated acres in the southeastern desert area of California. This report describes the results of the first year of sampling and analyzing (1) water in the drains, (2) bed material in the drains, (3) water from field tilerainage lines, and (4) irrigation tailwater and water in the drains directly exposed to drift from

aerial application of pesticides. Residues of almost all the pesticides selected for monitoring were found in water in the drains. Examination of the data to determine the probable source of pesticides indicated generally slight concentrations from bed material in the drains, usually no detectable concentrations from field tile-drainage lines, and apparently large concentrations from irrigation tailwater and drift from aerial application. (Woodard-USGS) W80-00942

HYDROLOGIC DATA FOR THE SOUTHWEST SUBSURFACE-INJECTION TEST SITE, ST. PE-TERSBURG, FLORIDA, Geological Survey, Tallahassee, FL. Water Re-

sources Div.

J. J. Hickey, and R. M. Spechler. Geological Survey open-file report 78-852, 1979. 104 p, 9 Fig, 29 Tab, 13 Ref.

Descriptors: \*Injection wells, \*Groundwater movement, \*Baseline studies, \*Waste disposal wells, \*Water quality, Tracers, Dye releases, Rhodamine, Forecasting, Path of pollutants, Aquifers, Water levels, Water analysis, Florida, \*Floridan aquifer, \*St. Petersburg(Fla).

aquifer, \*St. Petersburg(Fla).

Three injection wells and nine observation wells were constructed at the Southwest St. Petersburg, Fla, site to determine feasibility of injecting wastewater treatment plant effluent into permeable zones containing saline water. Two withdrawal tests and one injection test were performed. Both withdrawal tests ran for about 3 days; one discharging 650 gallons per minute, and the other discharging 6,490 gallons per minute. The injection test was run in one well for 91.1 days at an average rate of 2,830 gallons per minute. Injection well pressure reached a maximum of 48.1 pounds per square inch near the end of the test. Rhodamine WT was used as a tracer during the injection test and was identified in three wells. Before the injection test, chloride concentration in a well 35 feet from the injection well, and in a well 735 feet from the injection well, and in a well 735 feet from the injection well, and in a well 735 feet from the injection well, and in a well 735 feet from the injection well, sand in a well 735 feet from the injection well, sand in a well 735 feet from the injection well, sand in a well 735 feet from the injection well, sand in a well 736 feet from the injection well, sand in a well 736 feet from the injection well, sand in a well 736 feet from the injection well, sand in a well 736 feet from the injection well, sand in a well 736 feet from the injection well was 1,800 milligrams per liter the sand 5,400 milligrams per liter in another. Eleven wells hear the site were sampled before the test for water-quality analyses and chlorides ranged from water-quality analyses and chlorides ranged from 18 to 1,400 milligrams per liter. (Woodard-USGS) W80-00943

ONE-DIMENSIONAL STEADY-STATE
STREAM WATER-QUALITY MODEL,
Geological Survey, Lakewood, CO. Water Resources Div., and Geological Survey, NSTL Station, MS. Water Resources Div.
D. P. Bauer, M. E. Jennings, and J. E. Miller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 327, Price codes: A09 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-45, March 1979. 215 p, 3 Fig, 17 Ref.

Descriptors: \*Model studies, \*Water quality, \*Streams, \*Waste water disposal, \*Water pollution, Mathematical models, Nutrients, Biochemical oxygen demand, Dissolved oxygen, Nitrification, Phosphorus compounds, Coliforms, Bacteria, Streamflow, Runoff, Computer models.

A computer program, based on a one-dimensional mathematical model which predicts the stream water-quality response characteristics from wate source inputs, is described and documented. Variables predicted include dissolved oxygen, biochemical oxygen demand, nitrogen forms, total and fecal-coliform bacteria, orthophosphate-phosphorus, and various conservative substances. The model is based primarily on the Streeter-Phelps oxygen-sag equation. Special options of the program include the capability of handling nonpont source waste inputs and anoxic conditions. The model formulation is based on a steady-state assumption which requires constant flow rate of waste and stream discharges and associated parameters. To achieve a problem solution, each reach of a stream system is broken into a given number of subreaches, generally defined by locations of waste

#### Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

## Group 5B-Sources Of Pollution

or tributary inflow points. All waste constituents are assumed to be completely mixed within any cross section. (Woodard-USGS)

THE LIMNOLOGICAL RESPONSE OF WEST VIRGINIA MULTIPURPOSE I POUNDMENT TO ACID INFLOWS, Army Engineer District, Pittsburgh, PA. M. Koryak, L. J. Stafford, and W. H. Mostsoomer. Montgomery.

Water Resources Research, Vol 15, No 4, p 929-934, August 1979. 6 Fig, 2 Tab, 5 Ref.

Descriptors: \*Lakes, \*Limnology, \*Acid mine water, \*West Virginia, Sampling, Data processing, Acids, Water pollution, Pollutants, Path of pollutants, Water temperature, Density, Dissolved oxygen, Iron, Streamflow, Rivers, Water chemistry, Hydrogen ion concentration, Biological properties, Phytoplankton, Benthic fauna, \*Tygart River Lake(WV).

Periodic intrusions of acid mine drainage enter Tygart River Lake during the summer and autumn months. In spite of only moderate vertical thermal gradients in the reservoir, these inflows penetrate the impoundment as well-defined temperature-denthe impoundment as well-derined temperature-denisty currents. The depth of penetration and resulting mixing patterns of the acid inflows are influenced by the design and operation of the dam. The internal hydrodynamics of the reservoir, in turn, influence the chemistry and biology of both the impoundment and the outflow. (Sims-ISWS) impoundme W80-00954

A NEW NUMERICAL METHOD FOR SOLV-ING THE SOLUTE TRANSPORT EQUATION, Analytic Sciences Corp., Reading, MA. For primary bibliographic entry see Field 2F. W80-00956

SUSPENDED SEDIMENT SOURCES IDENTIFIED BY MAGNETIC MEASUREMENTS, Exeter Univ. (England). Dept. of Geography For primary bibliographic entry see Field 2J WERLINGEA

EFFECTS OF URBANIZATION GROUND-WATER QUALITY-A CASE STUDY, Wisconsin Univ. -Madison. Dept. of Geology and

C. Eisen, and M. P. Anderson. Ground Water, Vol 17, No 5, p 456-462, September-October 1979. 7 Fig, 3 Tab, 22 Ref. EPA R00514201.

Descriptors: \*Groundwater, \*Water pollution, \*Urbanization, \*Wisconsin, Pollutants, Path of pollutants, Water pollution sources, Chlorides, Sufates, Ammonia, Bacteria, Coliforms, Streptococus, Sampling, On-aite investigations, Watersheds(Basins), Cities, Effects, Wells, Water wells, Hydrology, Geology.

The results from a 1 1/2-year study of ground-water quality in the vicinity of Milwaukee, Wis-consin, supported the suggestion by other re-searchers that chloride and sulfate are the principal products of urbanization which alter groundwater chemistry. In addition to chloride and sulfate, groundwater samples from the Menomonee River Watershed contained relatively high concentra-tions of ammonium, fecal coliform, and fecal strep-tococci bacteria. Field data suspessed that contococci bacteria. Field data suggested that con-tamination of groundwater is caused by infiltration of surface water polluted by municipal and industrial wastes and (or) leakage from sewer lines. Some additional chloride contamination by infiltra-tion of road salt was also suggested. (Sims-ISWS) W80-00965

TEMPORAL VARIATION IN THE NUTRIENT EXPORT OF RIVERS DRAINING INTO THE BAY OF QUINTE, ONTARIO, CANADA, Canada Centre for Inland Waters, Burlington (On-

tario). C. K. Minns, and M. G. Johnson.

Water Resources Bulletin, Vol 15, No 4, p 1061-1072, August 1979. 5 Fig. 5 Tab, 6 Ref.

Descriptors: "Nutrients, "Rivers, "Lake Ontario, "Canada, Surveys, Sampling, Data processing, Nitrogen, Nitrates, Nitrites, Phosphorus, Varability, Temporal distribution, Drainage, Flow, Runoff, Regression analysis, Pollutants, Water pollution, "Bay of Quinte(Ontario).

Annual exports of total phosphorus, soluble reactive phosphorus, and total nitrogen were presented for the period 1965-1974 for 5 rivers draining into the Bay of Quinte, Lake Ontario. The export values were typical for the physiography and land use, though the results indicated that soluble reactive phosphorus exports for the 4 largest rivers tive phosphorus exports for the 4 largest rivers have been declining. Also, the variation in export of total phosphorus and total nitrogen was highly correlated with variation in annual runoff. This was noted as being a factor deserving more attention in future efforts to classify nutrient export values in relation to land use and geology. (Simsvess) ISWS) W80-00968

SOURCE ASSESSMENT: RECLAIMING OF WASTE SOLVENTS, STATE OF THE ART, Monsanto Research Corp., Dayton, OH. For primary bibliographic entry see Field 5A. W80-00988

PUBLIC ATTITUDES TOWARD COMMUNITY WASTEWATER RECLAMATION AND REUSE

OPTIONS, California Univ., Berkeley. School of Public

W H Bruvold

Available from the National Technical Information Available from the National Technical Information Service, Springfield, VA 22161 as PB80-110851, Price codes: A04 in paper copy, A01 in microfiche. Technical Completion Report, Contribution No.179, Water Resources Center, Univ. of Calif. Davis, August 1979, 52 p., 29 Tab, 1 Append. (Calif. Water Resources Center Project UCAL-WRC-W-515), OWRT-A-061-CAL(1).

Descriptors: \*Water reuse, \*Attitudes, \*Public health, Waste treatment, Irrigation, Environmental effects, California, Public reaction.

One hundred forty people in each of ten California cities were interviewed about their personal atti-tudes toward reclaimed water. Attitudinal results showed that respondents generally were unfavor-able disposed toward the use of reclaimed water for drinking. However, they did favor options that protected public health, enhanced the environment and conserved scarce water resources. High de-grees of treatment and then reuse for some beneficial purpose such as agricultural and parkland irri-gation was most favored, while minimal waste treatment and subsequent discharge into the envi-ronment without reuse was not favored. Cost did not appear to be an important factor in their decisions about reclaimed water. (Snyder-Calif) W80-01002

ANALYSIS OF MONITORING DATA FOR SUSPENDED SOLIDS, SOLUBLE PHOSPHO-RUS AND ADSORBED PHOSPHORUS AT THE

RUS AND ADSORBED PHOSPHORUS AT THE MENOMONEE RIVER,
Wisconsin Univ. -Madison. Dept. of Statistics.
R. B. Miller, W. Bell, and R. Y-Y Wang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-110844,
Price codes: A04 in paper copy, A01 in microfiche.
Water Resources Center, University of Wisconsin,
Partial Technical Report, 1979. 41 p. 15 Fig. 8
Tab, 1 Append. OWRT B-103-WIS (1). 14-34-0001-8129.

Descriptors: \*Sampling, \*Statistical methods, \*Water quality control, \*Regions, \*Great Lakes, \*Statistical models, Suspended solids, Phosphorus, \*Menomonee river(Wis)

Measurements of concentrations of suspended solids, soluble phosphorus and adsorbed phosphorus are categorized as having been collected during

high or low flow events. Within each category, variation in the concentrations is analyzed for the effects of variation in season of the year, time of day, and day of week. A small but persistent dayday, and day of week. A small out persistent day-of-the-week effect is present, suggesting somewhat periodic behavior over weeks. No significant time-of-day effect is discovered. A variety of figures and tables supplement the formal statistical calculations. W80-01004

REMOVAL OF 'SOLUBLE' IRON IN THE PO-TOMAC RIVER ESTUARY, Johns Hopkins Univ., Baltimore, MD. Chesapeake

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Bay Inst. For primary bibliographic entry see Field 5A.

DISCUSSION OF THE BEHAVIOUR OF NON-CONSERVATIVE DISSOLVED CONSTITU-ENTS IN ESTUARIES, Dartmouth Coll., Hanover, NH. Dept. of Earth

C. B. Officer.

Estuarine and Coastal Marine Science, Vol 9, No 1, p 91-94, July 1979. 3 Fig, 3 Ref.

Descriptors: \*Dispersion, \*Mixing, \*Dissolved solids, \*Aluminum, Model studies, Mathematical models, Pollutants, Path of pollutants, Metals, Salinity, Chemicals, Estuaries, Diffusion-advection models.

A simplified relation for the loss of a dissolved constituent in an estuary was derived. The relation is applicable to steady state, one dimensional, tidal averaged conditions. Caution should be exercised in its use, as well as in the measurement procedures and the interpretation of measurements of dissolved constituents, for such simplifications may not be appropriate, requiring more complex estuar-ine hydrodynamic effects to be considered. (Sims-ISWS) W80-01017

URBAN RUNOFF POLLUTION METHOD,

URBAN RUNOFF POLLUTION METHOD, GKY and Associates, Inc., Alexandria, VA. G. K. Young, T. R. Bondelid, and D. N. Athayde. Journal of the Water Resources Planning and Man-agement Division, American Society of Civil Engi-neers, Vol 105, No WR2, Proceedings Paper 14854, p 353-369, September 1979. 5 Fig, 2 Tab, 19 Ref, 2 Append. EPA 68-01-3594

Descriptors: \*Water pollution sources, \*Urban runoff, \*Water quality, \*Model studies, Mathematical models, Water pollution, Pollutants, Path of pollutants, Planning, Cities, Runoff, Storm runoff, Sewers, Combined sewers, Separated sewers, Storage, Effects, Hydrology, Environmental engineering

This work devised a simplified method to evaluate the event magnitude of nonpoint source rain-in-duced UBOD loads for urban areas. The method is duced UBOD loads for urban areas. The method is flexible, non-dependent upon computer simulation, and uses readily available data. The results appear to be realistic. Ten urban watersheds were studied using a methodology that assumes triangular hydrographs and piece-wize linear pollutographs. A rapid method for estimating pollutant loadings in terms of pounds per acre per storm was presented. UBOD was used in this study, but the methodology is readily adaptable to other parameters. The effects of storage and street sweeping on total storm loadings were preliminarily evaluated. (Sims-ISWS) storm loadings (Sims-ISWS) W80-01027

DENITRIFICATION IN THE NITROGEN BUDGET OF A RIVER ECOSYSTEM,
York Univ., Toronto (Ontario). Dept. of Geogra-

phy. A. R. Hill. Nature, Vol 281, No 5729, p 291-292, September 27, 1979. 2 Fig, 8 Ref.

Descriptors: \*Water quality, \*Denitrification, \*Rivers, \*Canada, Watersheds(Basins), Ecosys-

#### WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Sources Of Pollution-Group 5B

tems, Nitrogen, Aquatic environment, On-site investigations, Nitrates, Water samples, Analysis, Sediments, \*Duffin Creek(Ontario), Nitrogen

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Recent studies indicate that bacterial denitrification in anaerobic sediments may play a major part in removing nitrogen from water during river transport. As this reaction reduces nitrate-N primarily to gaseous nitrogen, it represents a potentially significant pathway for the permanent removal of nitrogen from aquatic environments. However, no detailed assessments have been made of the quantitative importance of denitrification in relation to river nitrogen budgets. The author investigated this problem by studying the role of denitrification in relation to the nitrogen budget of Duffin Creek near Toronto, Ontario, and reported that the remova. of nitrate-N by denitrification in the downstream reaches of the river represents 5-6% of the annual export of total nitrogen from this river basin. Duffin Creek has an average flow of 220,000 cu m/d and drains a predominantly rural watershed of 262 sq. km. Nitrogen from that watershed of 262 sq. km. Nitrogen from that watershed of 262 sq. km. Nitrogen fransport was measured at intervals along the two main branches of the river. (See also W77-12435) (Humphreys-ISWS)

NUMERICAL SIMULATION OF MATERIAL TRANSPORT IN A REGIONAL GROUND-WATER FLOW SYSTEM, California Univ., Livermore. Lawrence Livermore

For primary bibliographic entry see Field 2F. W80-01042

EFFECTS ON HATCHING IN LITTORINA LITTOREA AFTER AN OIL SPILL, Institute of Marine Research. Bergen (Norway).

J. F. Staveland.

Marine Pollution Bulletin, Vol 10, p 255-258, 1979. 4 Fig, 1 Tab, 10 Ref.

Descriptors: \*Oil spills, \*Toxicity, \*Snails, Gastropods, Reproduction, Oil, Oil pollution, Organic compounds, Fertility, Larval growth stage, Fecundity, \*Crude oil, \*Teratogens.

One year after an accidental spill of approximately 2000 t of Iranian crude oil on the west coast of Norway, specimens of the gastropod Littorina littorea were collected from the oil polluted shore and allowed to spawn in the laboratory. Snails were also collected from an unpolluted reference site. The oil contamination seemed to have no detectable effects on fertilization. However, the hatching success of the veliger larvae was significally less in the 'oil polluted' population. Some highly abnormal eggs were also observed in this egg population. (Deal-EIS) W80-01043

FINE PARTICULATE ORGANIC CARBON OUTPUT FROM FENS AND ITS EFFECT ON BENTHIC MACROINVERTEBRATES, California Univ., Berkeley. Dept. of Forestry and Conservation.
For primary bibliographic entry see Field 5A.
W80-01045

ZINC CONCENTRATIONS IN JUVENILE FLATFISH, Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Lab. For primary bibliographic entry see Field 5A. W80-01048

THE EFFECTS OF MACROPHYTES ON HY-DROCHEMISTRY OF THE SHALLOWS OF THE KREMENCHUG RESERVOIR, Akademiya Nauk URSR, Kiev. Inst. Hidrobiolo-For primary bibliographic entry see Field 5A. W80-01052

PHYSIOLOGICAL MECHANISMS OF THE ACTION OF TOXIC SUBSTANCES, AND AD-

APTATION OF AQUATIC ANIMALS TO AFIATOLI THEM, Akademiya Nauk SSSR, Borok Inst. Biologii Vnutrennykh Vod.

For primary bibliographic entry see Field 5A. W80-01057

UPTAKE AND ACCUMULATION OF CADMI-UM BY OPHRYOTROCHA DIADEMA (POLY-CHAETA), Biologische Anstalt Helgoland Hamburg. (Germany, F.R.).

For primary bibliographic entry see Field 5A. W80-01062

OBSERVATIONS OF MERCURY LEVELS IN BRANCHIOSTOMA CARIBAEUM, Swedish Water and Air Pollution Research Lab.,

For primary bibliographic entry see Field 5A. W80-01067

ACCUMULATION OF MERCURY AND SELE-NIUM IN CULTURED YELLOWTAIL, Shimonoseki Univ. of Fisheries (Japan). Dept. of Food Science and Technology. For primary bibliographic entry see Field 5A. W80-01068

THE EFFECT OF SEWAGE AND INDUSTRIAL WASTE DISCHARGES ON THE PRIMARY PRODUCTION OF A SHALLOW TURBULENT

Vikram Univ., Ujjain (India). School of Studies in Botany. For primary bibliographic entry see Field 5A. W80-01069

AN INVESTIGATION ON THE MERCURY CONTAMINATION OF PERSIAN GULF FISH, Tehran, Univ. (Iran). Dept. of Food Hygiene. For primary bibliographic entry see Field 5A. W80-01070

IN VIVO AND IN VITRO EFFECT OF PHENO-CLOR DP6 ON DRUG METABOLIZING AC-TIVITY IN MULLET LIVER,

Bordeaux Univ., Talence (France). Lab. de Physiologie de la Nutrition. For primary bibliographic entry see Field 5A. W80-01071

MIREX RESIDUES IN EGGS AND LIVERS OF TWO LONG-LIVED REPTILES (CHRYSEMYS SCRIPTA AND TERRAPENE CAROLINA) IN MISSISSIPPI, 1970-1977, Mississippi Univ. for Women, Columbus. Dept. of Physical Sciences.

For primary bibliographic entry see Field 5A. W80-01074

OIL CHANGE IN EXCRETORY PRODUCTS OF MUSSELS (MYTILUS GALLOPROVINCIA-

Institute of Biology of the South Seas, Sevastopol For primary bibliographic entry see Field 5A. W80-01075

SEDIMENT PENETRATION OF AMOCO CADIZ, OIL, POTENTIAL FOR FUTURE RELEASE, AND TOXICITY, Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab. For primary bibliographic entry see Field 5A. W80-01076

CELLULAR RESPONSES TO POLYCYCLIC AROMATIC HYDROCARBONS AND PHENOBARBITAL IN MYTILUS EDULIS, Institute for Marine Environmental Research, Plymouth (England).
For primary bibliographic entry see Field 5A.

W80-01077

FAILURE OF OSMOREGULATION WITH AP-PARENT POTASSIUM INTOXICATION IN MARINE TELEOSTS: A PRIMARY TOXIC EFFECT OF COPPER, Florida, Univ., Gainesville. Coll. of Veterinary

For primary bibliographic entry see Field 5A. W80-01079

THE RESPIRATORY RESPONSE OF JUVE-NILE MUD CRABS, RHITHROPANOPEUS HARRISII TO VARIATIONS IN SALINITY AND FOLLOWING SHORT-TERM EXPOSURE TO HALOWAX 1999, A POLYCHLORINATED NAPHTHALENE (PCN), Texas A and M Univ., College Station. Dept. of Biology.

Biology. For primary bibliographic entry see Field 5A. W80-01080

PREDICTING ROTENONE DEGRADATION IN LAKES AND PONDS,
New York State Dept. of Environmental Conservation, Albany.
For primary bibliographic entry see Field 5A.
W80-01082

RECOVERY OF 14C-LABELLED POLYCHLO-RINATED BIPHENYLS (PCB) IN FISH TISSUE USING A COMBUSTION AND A SOLUBILIZA-TION METHOD OF SAMPLE PREPARATION FOR SCINTILLATION ANALYSIS, Canada Centre for Inland Waters, Burlington (On-

For primary bibliographic entry see Field 5A. W80-01086

IDENTIFICATION OF TRANS-NONACHLOR IN GOBY-FISH FROM TOKYO BAY,
Tokyo Metropolitan Research Lab. of Public Health (Japan).
For primary bibliographic entry see Field 5A.
W80-01087

BIOLOGICAL AVAILABILITY OF SEDIMENT-BOUND CADMIUM TO THE EDIBLE COCKLE, CERASTODERMA EDULE, Bristol Univ. (England). Dept. of Inorganic Chem-For primary bibliographic entry see Field 5A. W80-01088

BENZO(A)PYRENE CONCENTRATIONS IN MUSSELS (MYTILUS EDULIS) FROM YA-QUINA BAY, OREGON DURING JUNE 1976-MAY 1978. Oregon State Univ., Corvallis. Dept. of General Science. For primary bibliographic entry see Field 5A. W80-01092

PCB RESIDUES IN BIVALVES AND SEDI-MENTS OF RARITAN BAY, Industrial Environmental Research Lab.-Cincin-nati, Edison, NJ. For primary bibliographic entry see Field 5A. W80-01093

HATCHING SUCCESS AND LARVAL MORTALITY IN AN ESTUARINE TELEOST, MENIDIA MENIDIA (LINNAEUS), EXPOSED TO CADMIUM IN CONSTANT AND FLUCTUATING SALINITY REGIMES, Environmental Research Lab., Narragansett, RI. For primary bibliographic entry see Field 5A. W80-01096

MONITORING TRACE ELEMENTS IN THE MUSSEL, MYTILUS EDULIS USING X-RAY ENERGY SPECTROSCOPY, Simon Fraser Univ., Burnaby (British Columbia).

## Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

#### Group 5B-Sources Of Pollution

For primary bibliographic entry see Field 5A. W80-01100

OPERATIONAL SPRAYING OF ACEPHATE TO SUPPRESS SPRUCE BUDWORM HAS MINOR EFFECTS ON STREAM FISHES AND INVERTEBRATES,

Maine Univ. at Orono. Dept. of Zoology.
C. F. Rabeni, and J. G. Stanley.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 327-333, 1979. 3 Fig. 3 Tab, 18
Ref.

\*Pesticide toxicity, \*Ecosystems, Descriptors: Pesticite kinetics, Fish physiology, Brook trout, Atlantic salmon, Suckers, Fish behavior, Enzymes, Aquatic insects, Insecticides, Forest management, Invertebrates, Growth rates, Streams, \*Acephate, \*Acetylcholinestase, \*Tissue analysis.

This study examined the effects of spraying of acephate on a stream ecosystem. The specific objectives were to measure: (1) Acetylcholinesterase (AChE) activity of fish brains as an index to direct effect. (2) Examine the effect of spraying on fish feeding. (3) Compare the growth of adult and young-of-the -year salmonids from treated and control streams. (4) Document the effects of spraycontrol streams. (4) Document the effects of spraying on macroinvertebrate standing crop and drift. Brook trout (Salvelinus fontinalis), landlocked (Salmo salar), longnose sucker (Catostomus catostomus) and common sucker (C. commersoni) were captured by electrofishing. Brain AChE activity was depressed in suckers but not salmonids exposed to acephate. Brook trout unexposed to acephate preyed primarily on immature aquatic insects; Ephemeroptera, Plecoptera, Diptera, and Trichoptera. Fish captured 1 and 2 days post-spray consumed significantly more terrestrial forms including beetles, moths, wasps, and spiders. The effect of the insecticide on fish diet was transient. The growth of the different year classes of brook trout and landlocked Atlantic salmon was about the same between the treated and control streams. No unusual growth patterns were evident. The No unusual growth patterns were evident. The variation in numbers of benthic invertebrates collected using the Surber sampler was high; some standard deviations were as large as the mean. standard deviations were as large as the mean. Changes in standing crop of most taxa followed no consistent pattern and did not correlate with in-crease in the drift, therefore we conclude that population densities of benthos were not affected by the insecticide. (Deal-EIS) W80-01103

EFFECTS OF SIMAZINE ON THE BLUE-GREEN ALGA ANACYSTIS NIDULANS, Langston Univ., OK. R. S. Metha, and K. W. Hawxby.

Bulletin of Environmental Contamination & Toxicology, Vol 23, p 319-326, 1979. 5 Fig, 1 Tab, 16

Descriptors: \*Pesticide toxicity, \*Cyanophyta, \*Electron microscopy, Algae, Herbicides, Metabolism, Pesticide kinetics, Mode of action, Photosynthesis, Cytological studies, Chemical analysis, Chemical properties, Mortality, Chlorophyll, Biochemistry, \*Simazine, \*Anacystis, \*Organelles.

Anacystis nidulans was studied in an attempt to Anacystis indulans was studied in an attempt to determine which organelles were affected by the herbicide simazine. A 10-day culture was treated with simazine at a concentration of 10-5M. Samples were removed and studied after 0, 12, 24, 48, and 33 hours following exposure. The effects of simazine on Anacystis were noticeable first on thylakoids and then on PB. The mode of reaction after 12 br of treatment anneared to be: (1) thylaafter 12 hr of treatment appeared to be: (1) thyla-koids appeared to develop granularity, (2) granular bodies became conspicuous over thylakoids and, as action of simazine became severe (48 hr after treatment) thylakoids appeared empty, distorted, and functionless. The PB became larger, fewer, and appeared membrane bound with increase in time of treatment. The death of a cell was indicated by empty distorted thylakoids, depletion of RNA and disintegration of PB last, compared to other cell organelles. Separate biochemical measurements showed that RNA content in simazine treated cells

after 48 hr was less than the control. A decrease in chlorophyll content was also noted in exposed cultures. (Deal-EIS) W80-01104

TOTAL AND ORGANIC MERCURY IN MARINE FISH OF THE UPPER GULF OF THAILAND,

Chulalongkorn Univ., Bangkok (Thailand). Inst. of Environmental Research. For primary bibliographic entry see Field 5A. W80-01105

EFFECTS OF COREXIT 9527 ON THE HATCH-ABILITY OF MALLARD EGGS,
Fish and Wildlife Service, Laurel MD. Patuxent
Wildlife Research Center.
For primary bibliographic entry see Field 5A.
W80-01107

NUTRIENT DISCHARGE FROM A 90 KM2 WATERSHED.

J. J. Edens, and S. O. Soldberg. Progress in Water Technology, Vol 8, No 4-5, p 85-89, 1977. 5 Fig. 1 Tab, 7 Ref.

Descriptors: \*Phosphorus, \*Nitrogen, \*Nutrients, \*Water pollution sources, \*Agricultural water-sheds, \*Non-point sources, Denmark, Cycling nutrients, Runoff, Watersheds(Basins), Drainage, Sewerage, Flow, Farms, Agriculture, Farm wastes, Fertilizers, Water pollution.

Agricultural runoff is responsible for most of the mitrogen discharge in a watershed in southwest Denmark. The watershed has a total area of 90 sq. Mr., 74% of which is farmland, 26% is forests and plains. Fewer than one-fourth of the population of 850 have sanitary facilities connected to sewer systems; others drain the sewage into the ground. There is no industry in the watershed. Data was collected once a week for a 24 hour period April 1973-May 1974; parameters include nitrogen compounds, phosphorus compounds, oxygen demand, pH, water flow, water temperature, and precipitation. The average yearly flow is 11.1 1/s/sq km and the total nutrient discharge was 12.9 kg N/ha/yr and 0.55 kg N/ha and 0.17 kg P/ha for the watershed. The farmland is both cultivated and fertilized and one-half of it has artificial drainage. Annual fertilization in the total watershed is 90 kg N/ha and 20 kg P/ha. Farmland, forest, area, precipitation, and groundwater were considered in evaluating the discharge. Nutrient discharge excluding contribution from the population is 12.4 kg N/ha/yr and 0.18 kg P/ha/yr. (Danovich-Wisconsin) W80-01126 Agricultural runoff is responsible for most of the

NITROGEN IN ORGANIC MATTER AND FER-TILIZER AS A SOURCE OF POLLUTION, Institute for Soil Fertility, Groningen (Nether-

For primary bibliographic entry see Field 5C. W80-01128

THE INFLUENCE OF NITROGEN FERTILIZ-ERS ON STREAM NITRATE CONCENTR TIONS NEAR ALLISTON, ONTARIO CANADA

York Univ., Downsview (Ontario). Dept. of Geography. For primary bibliographic entry see Field 5C. W80-01130

MODELS FOR PREDICTING WATER POLLU-TION FROM AGRICULTURAL WATER-SHEDS,

Science and Education Administration, Chickasha, OK. Southern Great Plains Watershed Research

For primary bibliographic entry see Field 5C. W80-01133

METHOD AND APPARATUS FOR UTILIZING ACCUMULATED UNDERGROUND WATER IN

THE MINING OF SUBTERRANEAN SUL-PHUR.

Freeport Minerals Co., New York. (Assignee For primary bibliographic entry see Field 2F W80-01180

ENVIRONMENTAL IMPROVEMENT AT NER-OUTSOS INLET, B. C. VOLUME 1 SUMMARY REPORT,

Rayonier Canada (B.C.) Ltd., Port Alice. For primary bibliographic entry see Field 5A. W80-01192

ENVIRONMENTAL IMPROVEMENT AT NER-OUTSOS INLET, B.C. VOLUME 2 WATER QUALITY AND BIOLOGICAL STUDIES IN NEROUTSOS INLET, B.C. ITT Rayonier Inc., Shelton, WA. Olympic Re-search Div.

search Div.
P. G. Corbett, J. P. Campbell, and S. H. Olsen.
Rayonier Canada (B.C.) Limited, December, 1978,
103 p, 20 Fig, 13 Tab, 12 Ref.

Descriptors: \*Pulp & paper industry, \*Pulp wastes, Water quality, Estuaries, \*Vancouver Island, Neroutsos Inlet, Water pollution effects, Dissolved oxygen, Hydrogen ion concentration, Phytoplankton, Diatoms, Protozoa, Primary productivity, Benthos, Intertidal

Following improvements in waste treatment in 1977, the waste concentration in Neroutsos Inlet and Quastion Sound improved. Both dissolved oxygen and pH improved although they varied over a wide range. Primary production has increased in 1978. There was an increase in intertidal creased in 1978. There was an increase in intertidal organisms in the outer fringes of areas bordering the mill. A plankton sampling program indicated that water quality improved in 1978, as indicated by increased numbers and kinds of diatoms. The amount of stalked protozoa was about the same. Phytoplankton grab samples were not useful in evaluating changes in water quality. (Katz-EIS) W80-01193

# 5C. Effects Of Pollution

MASOTEN (DYLOX) AS A CONTROL FOR CLAM SHRIMP IN HATCHERY PRODUCTION PONDS, Fish and Wildlife Service, San Marcos, TX. Fish Cultural Development Center. For primary bibliographic entry see Field 5A. W80-00802

THE EFFECTS OF HEATED WATER ON WARMWATER FISH IN EARTHEN

Alabama Univ., Auburn. Dept. of Fisheries and Alabama Univ., Auburn. Dept. of Fisheries and Allied Aquacultures. C. J. Turner, J. M. Lawrence, and D. R. Bayne. Proceedings of the Thirty-First Annual Confer-ence Southeastern Association of Fish and Wildlife Agencies, Vol 31, p 332-342, 1977. 2 Fig. 4 Tab, 17

Descriptors: \*Heated water, \*Toxicity, \*Fish populations, Bass, Channel catfish, Sunfishes, Growth rates, Water temperature, Heat resistance, Fish physiology, Fish reproduction, Spawning, Mortality, Fish management, \*Shad.

Two-year studies were conducted in 3 earthen raceways. One raceway was maintained at ambient water temperature, 1 had a heated floating plume over 60% of the surface, and 1 was maintained at near heated water discharge temperature. Average water temperatures ranging up to 36.7C were not lethal for any fish species tested. With the possible exception of threadfin shad no difference in longterm survival of any species was detected, but when the entire population was considered as a whole, survival of fishes confined to the highest temperatures was reduced. Growth rates of largemouth and spotted basses, channel catfish, redear sunfish, and gizzard shad in at least 1 of the heated water treatments exceeded growth in the control. Total standing crop and growth rates of bluegill

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Effects Of Pollution-Group 5C

and drum were lowest in the treatment with highest water temperatures. Little difference was seen between the control and the treatment with a floating heated water plume. (Deal-EIS) W80-00803

EVALUATION OF AN AIR-BUBBLE CURTAIN TO REDUCE IMPINGEMENT AT AN ELEC-TRIC GENERATING STATION, Texas Instruments Inc., Dallas, TX. Ecological

Services. For primary bibliographic entry see Field 5A. W80-00804

SALINITY STRESS AND SWIMMING PER-FORMANCE OF SPOTTED SEATROUT, Texas, Univ. at Austin, Port Aransas. Port Aransas Marine Lab.

For primary bibliographic entry see Field 5A. W80-00805

A RECURRENCE MODEL FOR THE PREDICTION OF DDT FLUX IN ATLANTIC MENHADEN, National Marine Fisheries Service, Beaufort, NC.

For primary bibliographic entry see Field 5B. W80-00806

EFFECTS OF MASOTEN (DYLOX) ON PLANK-TON IN EARTHEN PONDS, Fish and Wildlife Service, San Marcos, TX. Fish Cultural Development Center. For primary bibliographic entry see Field 5A. W80-00807

EFFECTS OF A PUMPED STORAGE HYDRO-ELECTRIC PLANT ON RESERVOIR TROUT HABITAT, Fish and Wildlife Service, Clemson, SC. Southeast Reservoir Investigations. For primary bibliographic entry see Field 5A. W80-00808

REPRODUCTION REPRESSION OF LARGE-MOUTH BASS IN A HEATED RESERVOIR, Texas Parks and Wildlife Dept., San Antonio. For primary bibliographic entry see Field 5A. W80-00810

MIGRATION OF SAUGER PAST A THERMAL DISCHARGE IN MELTON HILL RESERVOIR, Tennessee Valley Authority, Norris. Div. of For-estry, Fisheries and Wildlife Development. For primary bibliographic entry see Field 5A. W80-00811

HEAT TOLERANCE OF FREE-LIVING ESTUARINE ANIMALS TO PREDICT THEIR SURVIVAL IN HEATED EFFLUENTS,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
K. S. Chung, and K. Strawn.
Proceedings of the Thirty-First Annual Conference Southeastern Association of Fish and Wildlife Agencies, Vol 31, p 612-617, 1977. 1 Fig, 20 Ref.

Descriptors: \*Heat resistance, \*Toxicity, \*Entrainment, Thermal pollution, Seasonal, Mortality, Thermal powerplants, Outlets, Cooling waters, Water temperature, Crustaceans, Animal physiology, Fish physiology, Crabs, Thermal stress, Bacilif, Texas, P. H. Robinson Generating Station, Galveston Bay.

Individual heat resistance times were determined in 180 min experiments during June 1974 through September 1975 for 8 species of crustaceans and 47 fishes taken directly from the intake canal of the P. H. Robinson Generating Station, Bacliff, Texas. Individual resistance times increased with an increase in capture temperature and with a decrease in test temperature. June-September is the most thermally critical period of the year for animals transported by the power plant from intake water

and exposed to hot discharge effluent. During the rest of the year, nearly all organisms survived 3 h at temperatures higher than average discharge canal temperature. (Deal-EIS) W80-00812

SOME EFFECTS OF DREDGED MATERIAL DISPOSAL ON BENTHIC INVERTEBRATES AND SHOREBIRDS IN GRAYS HARBOR, Washington State Dept. of Game, Aberdeen. R. Albright, and J. L. Smith. In: Proceedings of the Symposium on Terrestrial and Aquatic Ecological Studies of the Northwest, March 26-27, 1976, EWSC Press, Chenney, Washington, p 233-240 (1976). 1 Fig, 8 Ref.

Descriptors: \*Dredging, \*Dredge spoils, \*Intertidal areas, Benthos, Washington, Grays Harbor, Benthic invertebrates, \*Shore birds, Clams, Amphipoda, Conophium, Dunlin, Western sandpipers, Red knots, Dowitchers, Elevation.

pnipoda, Conophium, Dunini, western sandpipers, Red knots, Dowitchers, Elevation.

Corophium stimpsoni was the numerically dominant benthic invertebrate occupying the intertidal zone in the inner portions of Grays Harbor, Washington. Other important invertebrates included clams, an amphipod, the cumacean Leptocuma sp. and several polychaete species. Dunlin were the most abundant of the seven species of shorebirds in the area, feeding primarily on C. stimpsoni. Western Sandpipers, Red Knots, and Dowitchers were also numerous. As many as 70,000 small shorebirds used the area during migrations. Elevation was increased by a mean of 0.85 m per station in the disposal site during the 1975 disposal operation. After dredge disposal, all stations were over 2.13 m above MLLW, and all but one over 2.44 m. As a result, the mean number of benthic invertebrate species per station was decreased by 61.6 percent compared to an adjacent contrast area. The mean number of individuals and biomass were reduced by at least 96.8 percent and a change in species composition occurred. Sampling in other areas showed that the number of benthic invertebrates, especially C. stimpsoni, was reduced at elevations above +2.13 m. The mean number of C. stimpsoni after disposal was 22 per sq m at the disposal site, while the adjacent contrast area had a mean of 6063 C. stimpsoni per sq m. The mean numbers of feeding shorebirds were at least 100 times higher below +2.13 m than above that elevation at the disposal area. Seven shorebird species were observed feeding below +2.13 m while only three fed above that elevation. (Katz-EIS)

EFFECTS OF GAS SUPERSATURATION ON FISH IN THE COLUMBIA RIVER, National Marine Fisheries Service Seattle, WA. For primary bibliographic entry see Field 5A. W80-00814

ORGANOTIN RESISTANCE IN GREEN SEA-

ORGANOTIN RESISTANCE IN GREEN SEA-WEEDS,
Leeds Univ. (England). Dept. of Plant Sciences.
M. E. Callow, P. A. Millner, and L. V. Evans.
In: Proceedings of the Ninth International Sea-weed Symposium, A. Jensen and J. R. Stein, Eds.,
Science Press, Princeton, p 191-197, 1977. 3 Fig, 6

Descriptors: \*Toxicity, \*Respiration, \*Marine plants, Metals, Absorption, Photosynthesis, Organic compounds, Membrane processes, Proteins, Inhibition, Fouling, Metabolism, Plant physiology, Tin, \*Organotins, \*Biocides, \*Seaweeds, \*Enteromorpha, \*Ulothrix.

The degree of inhibition of respiratory oxygen uptake in both Enteromorpha intestinalis and Ulothrix flacca spores was similar at each of the concentrations of triphenyltin chloride (SnPh3Cl) used. However, the inhibition of photosynthetic oxygen evolution was greater in Enteromorpha than in Ulothrix over the same concentration range. Uptake of 113SnPh3Cl by Enteromorpha spores was greater in the light than in the dark, whilst in Ulothrix the converse situation was found. Pre-incubation of Ulothrix spores with CCCP (carbonyl cyanide, m-

chlorophenylhydrazone) in the light resulted in increased uptake of SnPh3Cl. The possible operation of an active detoxification mechanism in Ulothrix is discussed. (Deal-EIS)

HEAVY METAL EXCHANGE BY ASCOPHYL-LUM NODOSUM (PHAEOPHYCEAE) PLANTS IN SITU, Trondheim Univ. (Norway). Inst. of Marine Bio-chemistry.

For primary bibliographic entry see Field 5B. W80-00816

AUTOMATIC CULTURE SYSTEMS FOR GROWING LAMINARIA SACCHARINA (PHAEOPHYCEAE) AND TESTING THE EFFECTS OF POLLUTANTS, Biologische Anstalt Helgoland, Hamburg (Germany, F.R.).

For primary bibliographic entry see Field 5A. W80-00817

EFFECT OF PULP MILL EFFLUENT ON PRO-DUCTIVITY OF SEAWEEDS, Nova Scotia Research Foundation, Dartmouth. For primary bibliographic entry see Field 5A. W80-00818

COMPOSITION OF BENTHIC MARINE ALGAE IN RELATION TO POLLUTION IN THE SETO INLAND SEA, JAPAN, Kobe Univ. (Japan). Dept. of Botany. For primary bibliographic entry see Field 5A. W80-00819

SENSITIVITY OF SOME BROWN ALGAL RE-PRODUCTIVE STAGES TO OIL POLLUTION, Environmental Research Lab., Narragansett, RI. For primary bibliographic entry see Field 5A. W80-00820

AN ASSESSMENT OF DDT TOXICITY ON OS-MOREGULATION AND GILL NA,K-ATPASE ACTIVITY IN THE BLUE CRAB, Emporia State Univ., KS. Div. of Biological Sci-

For primary bibliographic entry see Field 5A. W80-00822

EXCRETION OF THE LAMPRICIDE BAYER 73 BY RAINBOW TROUT, Fish and Wildlife Service, La Crosse, WI. Fish Control Lab. For primary bibliographic entry see Field 5B. W80-00824

RELATIONSHIP OF THE PHYSIOLOGY OF AQUATIC ORGANISMS TO THE LETHALITY OF TOXICANTS: A BROAD OVERVIEW WITH EMPHASIS ON MEMBRANE PERMEABIL

Clemson Univ., SC. Dept. of Environmental Systems Engineering.
For primary bibliographic entry see Field 5A.
W80-00825

RESPIRATORY ACTIVITY OF FISH AS A PREDICTOR OF CHRONIC FISH TOXICITY VALUES FOR SURFACTANTS, Proctor and Gamble Co., Cincinnati, OH. Ivory-dale Technical Center.

For primary bibliographic entry see Field 5A. W80-00826

USE OF LUMINESCENT BACTERIA FOR DE-TERMINING TOXICITY IN AQUATIC ENVI-RONMENTS,

Beckman Instruments, Inc., Carlsbad, CA. For primary bibliographic entry see Field 5A. W80-00827

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## Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

## Group 5C-Effects Of Pollution

TAINT THRESHOLD OF DIPHENYL OXIDE IN RAINBOW TROUT,

Dow Chemical Co., Midland, MI. Environmental Sciences Research Lab. For primary bibliographic entry see Field 5A.

A CHRONIC TOXICITY TEST WITH THE MARINE COPEPOD ACARTIA TONSA, United States Testing Co., Inc., Hoboken, NJ. For primary bibliographic entry see Field 5A.

USE OF THE GRASS SHRIMP (PALAEMON-ETES PUGIO) IN A LIFE-CYCLE TOXICITY TEST.

Environmental Research Lab., Gulf Breeze, FL. For primary bibliographic entry see Field 5A. W80-00831

UPTAKE, DEPURATION, AND TOXICITY OF HEXAMETHYLPHOSPHORAMIDE IN AQUATIC ORGANISMS, Haskell Lab. for Toxicology and Industrial Medi-

cine, Newark, DE. For primary bibliographic entry see Field 5A.

DISTRIBUTION OF BENTHOS IN RELATION TO THE SULFIDE-CONTENT IN THE BOTTOM SEDIMENTS OF MIXO-POLYHALINE LAKE NOTORO, HOKKAIDO, Hokkaido Univ., Hako-date (Japan). Lab. of Marine Culture.

For primary bibliographic entry see Field 5A.

ACUTE TOXICITY OF VANADIUM TO TWO SPECIES OF FRESHWATER FISH, University of Southern California, Los Angeles. Dept. of Biological Sciences. For primary bibliographic entry see Field 5A.

W80-00836 TOXICITY OF FOUR SYNTHETIC PYRETH-ROID INSECTICIDES TO RAINBOW TROUT, Guelph Univ. (Ontario). Dept. of Environmental

Biology. nary bibliographic entry see Field 5A. W80-00837

EMBRYOTOXIC EFFECTS OF CRUDE OIL CONTAINING NICKEL AND VANADIUM IN MALLARDS.

Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.

For primary bibliographic entry see Field 5A. W80-00838

EVIDENCE FOR THE PROTECTIVE EFFECT OF METALLOTHIONEINS AGAINST INOR-GANIC MERCURY INJURIES TO FISH, Liege Univ. (Belgium). Lab. d'Oceanogoli For primary bibliographic entry see Field 5A. W80-00839

ENVIRONMENTAL BROMINE IN FRESH-WATER AND FRESHWATER ORGANISMS: FACTORS AFFECTING BIOACCUMULATION, Tennessee State Univ., Murfreesboro. Dept. of Chemistry and Physics. For primary bibliographic entry see Field 5A. W80-00840

ACUTE ENDRIN TOXICITY ON OXIDASES OF OPHIOCEPHALUS PUNCTATUS (BLOCH), Hindu Coll., Moradabad (India). Dept. of Zoology.

For primary bibliographic entry see Field 5A. W80-00842

STUDIES ON THE DEPURATION OF CADMI-UM AND COPPER BY THE AMERICAN OYSTER CRASSOSTREA VIRGINICA, Environmental Research Lab., Narragansett, RI. For primary bibliographic entry see Field 5B. W80-00843

POLLUTANT LEVELS IN THE GREAT SKUA CATHARACTA SKUA, Durham Univ. (England). Dept. of Zoology. For primary bibliographic entry see Field 5B. W80-00845

ORGANOCHLORINE RESIDUES IN EGGS OF THE ENDANGERED AMERICAN CROCO-DILE (CROCODYLUS ACUTUS), Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.

For primary bibliographic entry see Field 5A. W80-00848

ABERRATIONS IN THE NEUROSECRETORY CELLS OF A FRESHWATER PULMONATE, INDOPLANORBIS EXUSTUS, CHRONICALLY EXPOSED TO SUBLETHAL CONCENTRATION OF TWO MOLLUSCICIDES, BACL2 AND CUSO4, Marathwada Univ., Aurangabad (India). Dept. of Zoology.

Zoology. For primary bibliographic entry see Field 5A.

EFFECTS OF IN VIVO CADMIUM EXPOSURE ON ATPASSES IN GILL OF THE LOBSTER, HOMARUS AMERICANUS,

National Marine Fisheries Service, Highlands, NJ. Sandy Hook Sport Fisheries Marine Lab. For primary bibliographic entry see Field 5A. W80-00851

PARATHION CAUSES SECONDARY POISON-ING IN A LAUGHING GULL BREEDING COLONY, Fish and Wildlife Service, Victoria, TX. Gulf Coast Field Station.

For primary bibliographic entry see Field 5A. W80-00854

OCCURRENCE OF PCB RESIDUES IN BURBOT (LOTA LOTA) AND LAKE TROUT (SALVELINUS NAMAYCUSH) FROM THE CHURCHILL FALLS POWER DEVELOPMENT

Department of Fisheries and Environment, Halifax (Nova Scotia). For primary bibliographic entry see Field 5A. W80-00856

TOTAL RESIDUAL CHLORINE: THE EFFECT OF SHORT-TERM EXPOSURE ON THE EM-ERALD SHINER NOTROPIS ATHERINOIDES (RAFINESOUE).

Minnesota Pollution Control Agency, Roseville. For primary bibliographic entry see Field 5A. W80-00857

COMBINED EFFECTS OF TEMPERATURE, SALINITY AND CADMIUM ON DEVELOP-MENT, GROWTH AND MORTALITY OF MY-TILUS EDULIS LARVAE FROM THE WEST-ERN BALTIC SEA,

Kiel Univ. (Germany, F.R.). Inst. fuer Meereskunde

For primary bibliographic entry see Field 5B. W80-00858

TOXICITY AND TISSUE UPTAKE OF METH-YLMERCURY ADMINISTERED INTRAPERI-TONEALLY TO RAINBOW TROUT (SALMO GAIRDNERI RICHARDSON),

Alberta Univ., Edmonton. Dept. of Zoology. For primary bibliographic entry see Field 5A.

EFFECT OF A PCB (AROCLOR 1254) ON THE STRIPED HERMIT CRAB, CLIBANARIUS VITTATUS (ANOMURA: DIOGENIDAE) IN

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STATIC BIOASSAYS,
Texas A and M Univ., Galveston. Dept. of Biol-

ogy.
R. G. Stahl, Jr.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 91-94, 1979. 13 Ref.

Descriptors: \*Aroclors, \*Crabs, \*Toxicity, Polychlorinated biphenyls, Mortality, Bioassay, Lethal limit, Animal physiology, Resistance, Crustaceans,

Hermit crabs were exposed to one of seven concentrations of Aroclor 1254 (3, 5, 10, 15, 20, 25 and 30 microgram/L) for up to 96h. Within the concentrations tested no mortalities were observed. However, the crabs exposed to the three higher concentrations were less active than those in lower concentrations. A further exposure to 300 microgram (IAA) and 1544 febt (1545) and 1545 febt (1545). gram/L Aroclor 1234 failed to produce mortality in 96h in crabs already exposed to 30 microgram/L L (Deal-EIS) W80-00860

SEPARATE AND JOINT TOXICITY TO RAIN-BOW TROUT OF SUBSTANCES USED IN DRILLING FLUIDS FOR OIL EXPLORATION, Guelph, Univ. (Ontario). Dept. of Zoology. For primary bibliographic entry see Field 5A. W80-00864

INFLUENCE OF SALINITY AND CADMIUM ON CAPSULE STRENGTH IN PACIFIC HER-RING EGGS.

Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station. For primary bibliographic entry see Field 5A. W80-00865

INFLUENCE OF SALINITY AND CADMIUM ON THE VOLUME OF PACIFIC HERRING EGGS, Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station. For primary bibliographic entry see Field 5A. W80-00866

FLUXES OF PARTICULATE CARBON, NITROGEN, AND PHOSPHORUS IN THE UPPER WATER COLUMN OF THE NORTHEAST PA-

MATER COLUMN VALUE OF THE WAY OF T

Descriptors: \*Carbon, \*Nitrogen, \*Phosphorus, \*Cycling nutrients, \*Pacific Ocean, Pacific Coast Region, Chemical analysis, Nutrients, Biodegradation, Degradation(Decomposition), Nutrient budgets, Cycles, Upwelling, Coasts, Oceans, Water chemistry, Nutrient transport, Primary productivity, Chemical degradation, On-site data collections.

Particulate C, N, and P fluxes were investigated and in-situ rates of change in the upper 1000 m of the water column estimated by using three identical trap systems set at 50, 250, and 700 m in coastal waters, and 75, 575, and 1050 m in open Pacific Ocean waters. During high coastal productivity periods, C, N, and P fluxes of 36, 4.1, and 0.19 mmole sq m d were observed at 50 m. These values decreased with depth to 9.6 C, 0.9 N, and 0.053 P mmole sq m d at 700 m. Non-welling fluxes at 50 m were lower than these observed at 700 m during high productivity. Fluxes observed in onen ocean were lower than these observed at 700 m during high productivity. Fluxes observed in open ocean were lower still, ranging from 5.7 C, 0.41 N, and 0.014 P at 75 m to 1.0 C, 0.034 N, and 0.0011 P (mmole sq m d) at 1050 m. Under upwelling, C:N:P ratios were 180:18:1, while C:N values were 10:1. The ratios suggest that the material falling into the traps are similar to living phytoplankton. Open ocean N:P ratios were similar to those observed water are resulting expensions. served under non-upwelling conditions (30), while C:P ratios were considerably higher (from 410 at 75 m to 910 at 1050 m), suggesting that both P and

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Effects Of Pollution-Group 5C

N loss occurs with depth while C remains constant. A number of identifiable fecal pellet were collected in the traps: 320,000 (upwelling coast) for 17,000 (non-upwelling coast) pellets sq m d at 50 m, compared to 1,400 pellets sq m d at 75 m open ocean. The fluxes are consistent with in-situ DO, N, and P rates of change necessary to account for their vertical distribution. (Danovich-Wisconsin) W80-00967

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A PRELIMINARY STUDY OF ZOOPLANK-TON SOUND SCATTERING LAYERS IN BALSFJORDEN: STRUCTURE, ENERGETICS, AND MIGRATIONS, Tromso Univ. (Norway). Inst. of Biology and Ge-

Ology. C. C. E. Hopkins, S. Falk-Petersen, K. Tande, and H. C. Eilertsen. SARSIA, Vol 63, No 4, p 255-264, November 1978. 3 Fig. 2 Tab, 32 Ref.

Descriptors: "Zooplankton, "Diel migration, "Sound waves, "Spatial distribution, "Ecological distribution, "Balsfjorden, Norway, Light, Migration, Biorhythms, Diurnal, Acoustics, Coepods, Biological communities, Distribution, Norway, Fjords, Arctic, Biomass, Aquatic life.

Zooplankton sound scattering in Balsfjorden, a Norwegian fjord north of the Arctic circle, is dependent not only on spatial distribution, displacement volume, and biomass of individual zooplankton species, but also upon complex synergistic action of the component populations. The paper presents the preliminary results of a combination of acoustic and biological sampling of the dense 120 kHz sound scattering layer (SSL) in Balsfjordenover a 24 hr period April 5-6, 1977. Diurnal vertical migration of the SSL involved ascent towards the surface (0-50 m) from a deeper day depth (100over a 25 m jection Apin 30, 397. Sinhal vetrical migration of the SSL involved ascent towards the surface (0-50 m) from a deeper day depth (100-150 m) at about noon, followed by descent from the surface around midnight before finally approaching the previous day depth again. Migration is related to changes in incident and sub-surface radiation intensity. The SSL is composed of zooplankters present in large numbers and biomass. The general absence of fish, as noted from the 38 kHz sounder and pelagic trawl, indicates that 120 kHz sound scattering is a direct result of increased zooplankton concentration. Copepods account for up to 72% of the total SSL biomass and S. elegans are also large and abundant. Dominant zooplankters are changeable but an increased abundance and biomass of Thysancesas spp. is always positively associated with the SSL. M. longa migrations are positively associated with SSL movement, the result not only of an individual species, ment, the result not only of an individual species, but a community response representing different trophic levels. (Danovich-Wisconsin) W80-00983

NUTRIENT CHEMISTRY OF A LARGE, DEEP LAKE IN SUBARCTIC ALASKA, Alaska Univ., Fairbanks. Inst. of Water Resources. J. D. LaPerriere, T. Tilsworth, and L. A. Casper. EPA-600/78-088, September 1978. 128 p, 25 Fig, 26 Tab, 74 Ref, 1 Append.

Descriptors: \*Subarctic, \*Water quality, \*Nutrients, \*Limnology, \*Mathematical models, \*Lake Harding(AK), Alaska, Lakes, Water chemistry, Cycling nutrients, Zooplankton, Benthic fauna, Submerged plants, Rooted aquatic plants, Plankton, Growth rates, Productivity, Recreation, Oligotrophy.

gotrophy.

Lake Harding in central Alaska was investigated 1973 to 1975; water quality was assessed and future development environmental effects were predictionable development environmental effects were predictionable development environmental effects were predictionable development environmental in sometimes does not reach complete oxygen saturation in spring because thermal stratification is not broken due to wind absence. Plant nutrient concentrations are moderate. The lake supports low algal production (95.6 gm/sq/m/yr) comparable to other high latitude oligotrophic lakes. Vascular aquatic plant growth, 1.35 gm/sq/m/yr, is less important than algal growth. Zooplankton biomass is highest in late summer amounting to 10 times winter values. With 988 ha, 43 m maximum depth and 16 m mean depth, it is the closest recreational lake near Fair-

banks, Alaska. Extreme annual temperature variations produce thick ice cover most months broken by nearly temperate summer conditions. Annual heat budget is 19,600 cal/cm. Algal heterotrophy is important; phytoplankton under ice are dormant, indicated by very low productivity; however, chlorophyll-a measurements reveal high standing crops. A lake management model adequately describes nutrient loading effects on algal growth; peak growth occurs under spring ice. Bacterial contamination detected between 1966 and 1971 was due to improper sewage disposal methods at recreational areas; after proper methods were constructed in 1972, no excessive counts were recorded. (Danovich-Wisconsin)

A PROCEDURE FOR THE PREDICTION OF NITRATE LEVELS IN WATER SUPPLIES IN THE UNITED KINGDOM, Department of the Environment, Reading (England). Central Water Planning Unit.

M. J. Reeves.
Progress in Water Technology, Vol 8, No 4-5, p 161-177, 1977. 3 Fig, 4 Tab, 42 Ref.

Descriptors: \*United Kingdom, \*Methodology, \*Nitrates, \*Forecasting, \*Model studies, \*Water supply, England, Chalk, Water sources, Watersheds(Basins), Nitrogen, Aquifers, Fertilizers, Rivers, Groundwater, Systems analysis, Hydrology, Hydrogeology, River basins, Simulation analysis, Analytical techniques, Agriculture, Crop

production.

A new procedure indicates that nitrate levels in United Kingdom rivers respond more rapidly to changes in agricultural practices than do ground-water sources; monitoring of rivers may thus give advance notice of nitrate trends in aquifers. Sample calculations were made for a generalized chalk catchment in eastern England based on quantitative assumptions regarding nitrogen cycle, catchment hydrology and hydrogeology, and agricultural practices. Nitrate level in the chalk aquifer increased gradually from about 35 mg/l in 1950 to 50 mg/l in 1970, predicted to rise to 80 mg/l if agricultural practices persist. Over the same period nitrate levels in area rivers rose from about 30 mg/l to 50 mg/l, but no further increase is expected at a sustained level of agricultural development. The procedure was devised through initial analysis of the system as a whole with identification of physical mechanisms by which system components operate and interact. These mechanisms include those controlling nitrate additions and losses and those controlling nitrate additions and losses and those controlling nitrate additions and losses and those controlling nitrate additions and losse searches and the controlling nitrate additions and losse searches and the controlling nitrate additions and losse searches and the controlling nitrate additions and losses and those controll controlling nitrate movement rate. The second step was to construct a model able to simulate the was to construct a model able to simulate the system. Areas requiring additional research include rates of vertical movement and dispersion of nitrate in soils and unsaturated strata, variations in rainfall nitrogen content, nitrogen immobilized by unharvested crops, annual losses by soil denitrification, denitrification in aquifers, and nitrate loss in streams and rivers. (Lynch-Wisconsin) W80-00993

EFFECTS ON HATCHING IN LITTORINA LIT-TOREA AFTER AN OIL SPILL, Institute of Marine Research. Bergen (Norway). For primary bibliographic entry see Field 5B. W80-01043

SMALL OIL SPILL KILLS 10-20000 SEABIRDS IN NORTH NORWAY, Tromoe\_Univ. (Norway). Dept. of Zoology and

Marine Biology. R. T. Barrett.

Marine Pollution Bulletin, Vol 10, p 253-255, 1979. 1 Fig. 2 Tab. 3 Ref.

Descriptors: \*Oil spills, \*Water birds, \*Mortality, Norway, Oil pollution, Organic compounds, Tox-icity, Ducks, Animal populations, Reproduction, Water pollution effects, \*Uria, \*Guillemots,

An estimated 10-20,000 seabirds were killed by a very small oil spill off the coast of North Norway in March 1979. Despite the fact that over 90% of

these were Brunnich's Guillemots Uria lomvia, the breeding population of this species was not considered to have been seriously threatened by this spil. On the other hand, this episode did illustrate hlow extremely vulnerable certain seabird species are to oil. (Deal-EIS) W86-01044

FINE PARTICULATE ORGANIC CARBON OUTPUT FROM FENS AND ITS EFFECT ON BENTHIC MACROINVERTEBRATES, California Univ., Berkeley. Dept. of Forestry and

Conservation. For primary bibliographic entry see Field 5A. W80-01045

EFFECTS OF A THERMAL DISCHARGE ON REPRODUCTIVE CYCLES IN MYTILUS EDULIS AND MYTILUS CALIFORNIANUS (MOLLUSCA, BIVALVIA), California Univ., Berkeley. Dept. of Zoology. For primary bibliographic entry see Field 5A. W80-01046

NITROGEN GAS SUPERSATURATION DURING ARTIFICIAL AERATION AT LAKE CASITAS, CALIFORNIA, Limnological Associates, Kaneohe, HI. For primary bibliographic entry see Field 5A. W80-01030

LONG-TERM RESIDUAL EFFECTS OF PO-LYETHYLENEIMINE ON DAPHNIA, Moscow State Univ. (USSR). For primary bibliographic entry see Field 5A. W80-01051

AN OPTICAL METHOD FOR RECORDING CARDIAC RHYTHIM IN DAPHNIA, Vsesoyuznyi Nauchno-Issledovatelskii Inst. Tsel-lyulozno-Bumazhnoi Promyshlennosti, Leningrad

For primary bibliographic entry see Field 5A. W80-01053

THE CHRONIC EFFECT OF ALKALI ON THE GROWTH, DEVELOPMENT AND FECUNDITY OF THE GUPPY, Tsentralnyi Gosudarstvennyi Nauchno-Issledovatelskii Inst. Ozernogo i Rechnogo Rybnogo Khozyaistva, Baku (USSR). Azerbaijan Branch. For primary bibliographic entry see Field 5A. W80-01054

RED SWAMP CRAYFISH: SHORT-TERM EFFECTS OF SALINITY ON SURVIVAL AND GROWTH,

Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab. For primary bibliographic entry see Field 5A. W80-01056

PHYSIOLOGICAL MECHANISMS OF THE ACTION OF TOXIC SUBSTANCES, AND ADAPTATION OF AQUATIC ANIMALS TO THEM,
Akademiya Nauk SSSR, Borok. Inst. Biologii Vnutrennykh Vod.
For primary bibliographic entry see Field 5A.
W80-01057

TOXICITY OF SOME HEAVY METALS FOR DAPHNIA MAGNA STRAUSS, AS A FUNCTION OF TEMPERATURE, Akademiya Nauk URSR, Kiev. Inst. Hidrobiolo-

For primary bibliographic entry see Field 5A. W80-01059

THE MARINE LIFE OF AN OFFSHORE OIL PLATFORM,
International Biological Consultants, Encinitas,

## Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

## **Group 5C—Effects Of Pollution**

For primary bibliographic entry see Field 5A. W80-01060

ABORTION EFFECT IN CORALS INDUCED BY OIL POLLUTION, Tel Aviv Univ. (Israel). Dept. of Zoology. For primary bibliographic entry see Field 5A. W80-01061

UPTAKE AND ACCUMULATION OF CADMI-UM BY OPHRYOTROCHA DIADEMA (POLY-

CHAETA), Biologische Anstalt Helgoland Hamburg. (Ger-many, F.R.). For primary bibliographic entry see Field 5A. W80-01062

EFFECTS OF OXYGEN TENSION ON PUMP-ING, FILTRATION AND OXYGEN UPTAKE IN THE ASCIDIAN PHALLUSIA MAMMILLATA, Paris-6 Univ. (France), Lab. Arago. For primary bibliographic entry see Field 5A. W80-01063.

PERSISTENCE OF POLYCHLORINATED BI-PHENYLS AND 1,1-DICHLORO-2,2-BIS(P-CHLOROPHENYL) ETHYLENE (P.P-DDE) WITH AGE IN LAKE TROUT AFTER 8 YEARS, Cornell Univ., Ithaca, NY. Dept. of Food Science. For primary bibliographic entry see Field 5A. W80-01064

TEMPERATURE AND SALINITY EFFECTS ON THE ACUTE TOXICITY OF CADMIUM TO LAOMEDEA LOVENI (HYDROZOA), Kiel Univ. (Germany, F.R.). Inst. fuer Meereskunde

For primary bibliographic entry see Field 5A. W80-01065

TOXICITY OF COPPER COMPOUNDS FOR CHLORELLA PYRENOIDOSA BEYER, Moscow City Council (USSR). Inst. for the Design and Planning of the Water Supply and Sewer Systems. For primary bibliographic entry see Field 5A. W80-01066

IN VIVO AND IN VITRO EFFECT OF PHENO-CLOR DP6 ON DRUG METABOLIZING AC-TIVITY IN MULLET LIVER, Bordeaux Univ., Talence (France). Lab. de Physio-

logie de la Nutrition. For primary bibliographic entry see Field 5A. W80-01071

ACUTE TOXICITY TO SELENASTRUM CA-PRICORNUTUM OF AROMATIC COM-POUNDS FROM COAL CONVERSION, Oak Ridge National Lab. TN. For primary bibliographic entry see Field 5A. W80-01072

EFFECT OF SELECTED WATER TOXICANTS AND OTHER CHEMICALS UPON ADENO-SINE TRIPHOSPHATASE ACTIVITY IN SINE VITRO,

Environmental Research Lab. Duluth, MN. For primary bibliographic entry see Field 5A. W80-01073

MIREX RESIDUES IN EGGS AND LIVERS OF MINEA RESIDUES IN EGGS AND LIVERS OF TWO LONG-LIVED REPTILES (CHRYSEMYS SCRIPTA AND TERRAPENE CAROLINA) IN MISSISSIPPI, 1970-1977, Mississippi Univ. for Women, Columbus. Dept. of Physical Sciences. For primary bibliographic entry see Field 5A. W80-01074

SEDIMENT PENETRATION OF AMOCO CADIZ, OIL, POTENTIAL FOR FUTURE RE-LEASE, AND TOXICITY,

Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab. For primary bibliographic entry see Field 5A. W80-01076

CELLULAR RESPONSES TO POLYCYCLIC AROMATIC HYDROCARBONS AND PHENO-BARBITAL IN MYTILUS EDULIS, Institute for Marine Environmental Research, Plymouth (England). For primary bibliographic entry see Field 5A. W80-01077

THE RELATIONSHIP BETWEEN THE COPPER COMPLEXING CAPACITY OF SEA WATER ND COPPER TOXICITY IN SHRIMP

Battelle Pacific Northwest Labs., Sequim, WA. Marine Research Lab.

For primary bibliographic entry see Field 5A. W80-01078

FAILURE OF OSMOREGULATION WITH AP-PARENT POTASSIUM INTOXICATION IN MARINE TELEOSTS: A PRIMARY TOXIC EFFECT OF COPPER,

Florida, Univ., Gainesville. Coll. of Veterinary Medicine.

For primary bibliographic entry see Field 5A. W80-01079

THE RESPIRATORY RESPONSE OF JUVE-NILE MUD CRABS, RHITHROPANOPEUS HARRISII TO VARIATIONS IN SALINITY AND FOLLOWING SHORT-TERM EXPOSURE TO HALOWAX 1099, A POLYCHLORINATED NAPHTHALENE (PCN),
Texas A and M Univ., College Station. Dept. of

Biology.
For primary bibliographic entry see Field 5A.
W80-01080

EFFECTS OF LOGGING ON STREAM ENVI-RONMENTS AND FAUNAS IN NELSON, Marine Dept., Wellington (New Zealand). Fisher-Marine Dept., Wellington (New Zealand). Fies Research Div.
For primary bibliographic entry see Field 5A.
W80-01081

AN INVESTIGATION INTO THE EFFECTS OF THE PISCICIDE ANTIMYCIN A ON THE FISH AND INVERTEBRATES OF A SCOTTISH STREAM,

Freshwater Fisheries Lab., Pitlochry (Scotland). For primary bibliographic entry see Field 5A. W80-01083

THE EFFECT OF AMMONIA ON THE GROWTH OF JUVENILE DOVER SOLE, SOLEA SOLEA (L.) AND TURBOT, SCOPHTH-ALMUS MAXIMUS (L.), Ministry of Agriculture, Fisheries and Food, Port Erin (England). Fisheries Lab. For primary bibliographic entry see Field 5A. W80-01084

TOLERANCE OF DEVELOPING SALMONID EGGS AND FRY TO NITRATE EXPOSURE, Fish and Wildlife Service, Portland, OR. Div. of Ecological Services.
For primary bibliographic entry see Field 5A.
W80-01085

EXTRACTION AND GAS-LIQUID CHROMA-TOGRAPHIC ANALYSIS OF CHLORPHOXIM IN WATER AND FISH,

Center for Disease Control, Atlants, GA. Environ-mental Health Services, Div.

For primary bibliographic entry see Field 5A. W80-01089

AN EVALUATION OF THE ACUTE TOXICITY TO AQUATIC BIOTA OF A COAL CONVER-

SION EFFLUENT AND ITS MAJOR COMPO-

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NENTS, Oak Ridge National Lab., TN. For primary bibliographic entry see Field 5A. W80-01090

EFFECTS OF CHRONIC EXPOSURE TO ZINC ON REPRODUCTION IN THE GUPPY (POE-CILIA RETICULATA),

Alberta Univ., Edmonton. (Canada) Dept. of Zoo-

For primary bibliographic entry see Field 5A.

EFFECTS OF ALUMINUM AND NICKEL ON SURVIVAL AND REPRODUCTION IN POLY-CHAETOUS ANNELIDS,

California State Univ., Long Beach. Dept. of Biol-

For primary bibliographic entry see Field 5A. W80-01094

TOXICITY OF SODIUM PENTACHLORO-PHENATE TO JUVENILE CHINOOK SALMON UNDER CONDITIONS OF HIGH LOADING DENSITY AND CONTINUOUS-FLOW EXPOSURE.

PILOW EXPUSURE, British Columbia Dept. of Recreation and Conservation, Victoria. Fish and Wildlife Branch. For primary bibliographic entry see Field 5A. W80-01095

HATCHING SUCCESS AND LARVAL MORTALITY IN AN ESTUARINE TELEOST, MENIDIA MENIDIA (LINNAEUS), EXPOSED TO CADMIUM IN CONSTANT AND FLUCTUATING SALINITY REGIMES, Environmental Research Lab., Narragansett, RI. For primary bibliographic entry see Field 5A. W80-01096

EFFECT OF BARITE ON MEIOFAUNA IN A FLOW-THROUGH EXPERIMENTAL SYSTEM, Texas Instruments Inc., Buchanan, NY. For primary bibliographic entry see Field 5A. W80-01097

SUBLETHAL EFFECTS OF HEAVY METAL CONTAMINATED SEDIMENTS ON THE BIVALVE MACOMA BALTHICA (L.),

British Columbia Univ., Vancouver. Inst. of Oceanography. For primary bibliographic entry see Field 5A. W80-01098

EFFECTS OF WOOD WASTE ON SAND-BED BENTHOS.

British Columbia Univ., Vancouver. Dept. of Biol-

ogy. K. E. Conlan, and D. V. Ellis. Marine Pollution Bulletin, Vol 10, p 262-267, 1979.

Descriptors: \*Wood wastes, \*Toxicity, \*Benthic Jean, Polychaetes, Crustaceans, Industrial wastes, Biological communities, Dominant organisms, Aquatic populations, Biomass, Mode of action, Bark, \*Species diversity, Lumbering.

The impact on benthos of wood (abraded bark and wood) at an industrial log handling site was examined through the medium of the infauna of a shallow sand bed (depth 4-11 m). This sand bed supported a diverse biological community with abundant suspension-feeding polychaetes and bivalves.

Deposition of more than a 1 cm layer of wood waste produced noticeable losses of these suspenwaste produced noticeable losses of these suspen-sion feeders. The impact increased progressively with amount of waste deposited. The community inhabiting thickest deposit (up to 15 cm measured) had virtually lost the suspension feeding trophic pathway, was reduced in diversity and biomass, and was dominated by only a few abundant depos-it-feeding crustaceans and polychaetes, e.g. Nebalia pugettensis and Dorvillea annulata. (Deal-EIS) W80-01099

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Effects Of Pollution-Group 5C

THE EMBRYONIC DEVELOPMENT AND THE THERMAL EFFECTS ON THE DEVELOPMENT OF THE MOUNTAIN WHITEFISH, PROSOPIUM WILLIAMSONI (GIRARD), Utah Cooperative Fishery Unit, Logan. For primary bibliographic entry see Field 5A. W80-01101

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ood nity red) UPTAKE OF METHOXYCHLOR FROM FOOD AND WATER BY THE AMERICAN TOAD (BUFO AMERICANUS), Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center. For primary bibliographic entry see Field 5A. W80-01102

OPERATIONAL SPRAYING OF ACEPHATE TO SUPPRESS SPRUCE BUDWORM HAS MINOR EFFECTS ON STREAM FISHES AND

INVERTEBRATES,
Maine Univ. at Orono. Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W80-01103

EFFECTS OF SIMAZINE ON THE BLUE-GREEN ALGA ANACYSTIS NIDULANS, Langston Univ., OK. For primary bibliographic entry see Field 5B. W80-01104

CHARACTERISTICS OF SPORT FISHING ACTIVITY IN THREE WARM WATER DISCHARGES, Tennessee Valley Authority, Norris. Div. of Forestry, Fisheries, and Wildlife Development. For primary bibliographic entry see Field 5A. W80-01106

SOME EFFECTS OF CERTAIN METALS ON DEVELOPMENT AND MORTALITY WITHIN THE MOULT CYCLE OF CRANGON (L),

Hull, Univ. (England). Dept. of Zoology. For primary bibliographic entry see Field 5A. W80-01108

PRODUCTION AND BIOMASS OF CLADO-PHORA PROLIFERA (CHLOROPHYTA, CLA-DOPHORALES) IN BERMUDA, Allegheny Coll., Meadville, PA. Dept. of Biology. S. D. Bach, and M. N. Josselyn. Botanica Marina, Vol 22, p 163-168, 1979. 4 Fig, 2 Tab. 17 Ref.

Descriptors: \*Cladophora, \*Productivity, \*Biomass, Bermuda, Chlorophyta, Primary productivity, Growth rates, Tracers, Analytical techniques, Benthic flora, Light, Light intensity, Nutrients, Seasonal, Invasion, Competition, Adaptation, En vironmental effects.

vironmental effects.

Two possible factors explain the rapid spread of Cladophora in Bermuda as measured in a June 1977 study. (1) human activities could elevate nutrient levels; (2) C. prolifera could be an introduced species with adaptations enabling it to outcompete native species. C. prolifera productivity averages 0.567 mg C/gdw/h; average increase in wet weight/d is 1.8% increase/d. Plant productivity covered with a single Cladophora layer is reduced 90%. Productivity is higher at greater depths in June than previous measurements in December, 1976 due to greater light intensity. Productivity also sharply decreases with depth below nine m both year times, correlating light intensity and productivity. Both neutral response and decrease in productivity are observed in algae incusted with mat water. No effects are observed with ammonia or phosphate additions; this is explained by differences in plant reaction lag time' to different nutrients or by stored N and P. Productivity is measured by C-14 uptake, growth, and biomass accumulation. C-14 measurements show 3.1 gC/sq/m/d as mean production rate; in-situ increases show 2.7 gC/sq/m/d estimates. Mean C. prolifera biomass in June 1977 is 1838 gdw/sq/m, in December 1976 is 1495 gdw/sq/m, making pro-

ductivity rates 0.7 gC/sq/m/d. Since mean daily production rates are 3.1 gC/sq/m/d, remaining plant material is either removed physically by storm activity, decomposed, or lost by grazing. (Danovich-Wisconsin)

PHYSIOLOGICAL ECOLOGY OF ASCOPHYLLUM NODOSUM (L.) LE JOLIS AND ITS DETACHED ECAD SCORPIOIDES (HORNEMANN) HAUCK (FUCALES, PHAEOPHYTA), New Hampshire Univ., Durham. Dept. of Botany. J. S. Chock, and A. C. Mathieson.
Bottania Marina, Vol 22, No 1, p 21-26, 1979. 4 Fig, 24 Ref.

Descriptors: \*Plant physiology, \*Light intensity, \*Water temperature, \*Phaeophyta, \*Salinity, Photosynthesis, Light, Temperature, Algae, New Hampshire, Kelps, Ecology, Plant growth, Metabolism, Energy conversion.

olism, Energy conversion.

The fucoid brown alga Ascophyllum nodosum and its detached ecad scorpioides both tolerate a wide variety of light, temperature, and salinity regimes according to a summer 1974-winter 1975 New Hampshire study. Net photosynthetic rates for Ascophyllum nodosum and its detached ecad scorpioides were recorded using manometric techniques; specimens were collected from Adams Point, New Hampshire. No major physiological differences were evident between the two plants. Both exhibit pronounced seasonal differences in temperature and light responses, with winter plants producing oxygen at a lower rate (26 micro 1/O2/gDw/min at 1000 ft-c). Both also exhibit a eurythermal response to temperature, with optimum stronger during summer than winter. Winter specimens show a net photosynthetic plateau between 10 to 25 C, versus a conspicuous summer maximum of 18 to 21 C. Optimal light intensities (850 ft-c) with no seasonal optima differences; plants exhibit broad tolerance to high light intensities. Both A. nodosum and ecad scorpioides exhibit net photosynthesis decreases at intermediate salinities (18%) as sum and ecad scorpioides exhibit net photosynthesis decreases at intermediate salinities (18%) as compared to higher and lower salinities (40 or 0%). (Danovich-Wisconsin) W80-01111

EFFECTS OF HIGH AND LOW ULTRAVIO-LET FLUENCES ON THE FILAMENTOUS BLUE-GREEN ALGA ANABAENA L-31, Bhabha Atomic Research Centre, Bombay (India). Biology and Agriculture Div. T. Fernandes, and J. Thomas. Environmental and Experimental Botany, Vol 18, No 4, p 229-239, December 1978. 7 Fig, 3 Tab, 39 Ref.

Descriptors: \*Cyanophyta, \*Ultraviolet radiation, \*Photoactivation, Anabaena, Curves, Mortality, Plant physiology, Evolution, Adaptation, Biochemistry, Radiation, Algae, Light, Light intensity, Plant morphology, Cytological studies, Plant growth, Metabolism, Growth stages, Nitrogen fix-

ation.

Morphological pecularities such as giant cell formation, filament cell misalignment, Y-shaped branches, three-pored heterocysts, cross-shaped branches, and loop formations indicate UV-induced inhibition of cell division and disturbances in biochemical differentiation mechanisms. Induction of true branching is significant in the evolution of algae belonging to the Stigonematales. The nitrogen-fixing capacity of certain filamentous bluegreen algae has aroused great interest in the biology of these organisms. Differentiated cells, termed heterocysts, have been identified as the sites of nitrogen-fixation. Vegetative cells of Anabaena L-31 are much more sensitive to UV high and low fluences than Anabaena doliolum and Fischerella muscicola, the LD30 fluence being only 180 J/sq m compared with LD fluences of 300J/sq m and 2000 J/sq m respectively. The survival curve of Anabaena L-31 is unusual, having a broad shoulder, a narrow region of exponential kill, and a long tail. The quantitative and qualitative similarity of survival curves of Ana-

baena L-31 growing in nitrogen-fixing and non-nitrogen fixing conditions suggests that the nitro-genase enzyme system is not easily affected by UV. True photoreactivation was observed in heter-cyst-forming Anabaena L-31 exposed to white light after UV radiation. (Danovich-Wisconsin) W80-01112

NITRATE UPTAKE BY ENTEROMORPHA SPP. (CHLOROPHYCEAE): APPLICATIONS TO AQUACULTURE SYSTEMS, Rhode Island Univ., Kingston. Dept. of Botany.

M. M. Harlin. Aquaculture, Vol 15, No 4, p 373-376, December 1978. 3 Tab, 9 Ref.

Descriptors: \*Nitrates, \*Chlorophyta, \*Nutrient kinetics, \*Aquiculture, Inorganic compounds, Ni-trogen, Nutrient removal, Enteromorpha, Algae, Laboratory tests, Nutrient requirements, Deficient

elements.

Enteromorpha linza and E. intestinalis removed nitrates from a sea water test medium at rates considerably higher than those measured for other seaweeds. At 15 C these algae showed a V-max of 129 micro mol/h/g dry weight and a Ks of 17 micro M. At similar temperature and irradiance, Vmax and Ks for nitrates in Enteromorpha species are twice that of Codium fragile. In aquaculture systems where the objective is to strip nitrates from sea water, nitrate-rich water may be pulsed through tanks of Enteromorpha species during the day. Night feeding of Chondrus crispus culture tanks would capitalize upon the difference in nitrate uptake strategies between these two algae minimizing uptake by the Enteromorpha. This paper investigates three parameters that regulate nitrate uptake for Enteromorpha linza and E. intestinalis: temperature, lights, and substrate concentrations. At five C nitrate uptake was 19% of that measured at 15 C and at 0 C nitrate uptake was not detected. In darkness, nitrate uptake was reduced 35% in the first hour, 10% in the second hour. After standing in nitrate-depleted sea water, algae scavenged nitrate at concentrations 0.5 micro M and no nitrate leaked from the tissue into nitrate-free water. Nitrate uptake increased with increasing substrate concentrations. free water. Nitrate uptake increased with increasing substrate concentrations. (Danovich-Wiscon-

NUTRITIONAL EFFECT OF EIGHT SPECIES OF MARINE PHYTOPLANKTON ON POPU-LATION GROWTH OF THE ROTIFER, BRA-CHIONUS PLICATILIS,

Chlorella Co., Ltd., Toyoda (Japan). K. Hirayama, K. Takagi, and H. Kimura. Bulletin of the Japanese Society of Scientific Fish-eries, Vol 45, No 1, p 11-16, January 1979. 3 Fig. 3

Descriptors: \*Nutrient requirements, \*Phytoplank-ton, \*Rotifers, \*Laboratory tests, Population, Food chains, Productivity, Chlorella, Feeding rates, Plankton, Zooplankton, Growth rates, Microor-ganisms, Chlamydomonas, Fecundity.

Two species of Synechococcus elongatus and Chlorella sp were evaluated as excellent food plankton, four species of Chlamydomonas sp, Monochrysis lutheri, Dunaliella tertiolecta and Cyclotella cryptica as average, and two species of Eutroptiella sp and Nitzschia clostelium as deficient in nutritional effect on rotifers under sterile laboratory conditions. The rotifer Brachionus plicatilis is one of the important food organisms for mass cultivation of fish larvae as well as planktonic crustaceans. Nutritional effects of eight marine inhytoplankton species on rotifers were investigative. crustaceans. Nutritional effects of eight marine phytoplankton species on rotifers were investigated by feeding a single species to rotifers under axenic culture conditions. First-laid eggs of amictic rotifers were divided into two groups, one cultured with a marine phytoplankton species, the other with Chlorella sp as control in a modified Erdschreiber medium. For the Chlorella sp the cell concentrations were 1,500,000 cells/ml. Cell concentrations of the other phytoplankton species varied centrations were 1,300,000 cens/mi. Cell colored trations of the other phytoplankton species varied according to the highest value of indicies, the most desirable cell concentration. In evaluating phyto-plankton nutritional effects, the intrinsic population

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

## Group 5C-Effects Of Pollution

growth rate (r) and net production rate (Ro) were calculated from daily observations of survival rate and fecundity of many individual rotifers. Results were classified into three categories where relative r and Ro values for eight phytoplankton species were compared to those for the marine Chlorella: excellent (r or = 0.7, Ro or = 0.6), average (0.4 or = r 0.7, 0.3 or = Ro 0.6) and deficient (0.4 r, 0.3 Ro). (Danovich-Wisconsin)

NOTES ON THE PLANKTONIC ROTIFERS OF LAKE ONTARIO,

A. Nauwerck Archiv fur Hydrobiologie, Vol 84, No 3, p 269-301, November 1978. 9 Fig, 5 Tab, 24 Ref.

Descriptors: \*Physiological ecology, \*Speciation, \*Rotifers, \*Biomass, \*Distribution, \*Lake Ontario, Heterogeneity, Variability, Zooplankton, Great Lakes, Secondary productivity, Population, Ecological distribution, Seasonal, Systematics, Cycles, Asimal behavior.

Rotifer composition, abundance, and morphometrical properties were studied in quantitative net sam-ples collected from Lake Ontario, during 1970. Polyarthra vulgaris, Keratella cochlearis coch-learis, Synchaeta lackowitziana, and Keratella earlearis, Synchaeta lackowitziana, and Keratella earlinae dominate among 47 identified taxa. Synchaeta, Notholca, and Kellicottia dominate in
winter; in summer, Keratella, and in autumn, Polyarthra are most important species. Diversity
is highest in early summer and is high again in late
fall. Keratella irregularis is new for North America.
Keratella hispida, considered extremely rare in
North America, is common in Lake Ontario. Keratella cachelaris terseagel form acidolikui cachellikui cachellikui to excellente. North America, is common in Lake Ontario. Kera-tella cochlearis temporal form variability is consid-erable, displaying seasonal Lauterborn cycles. Low rotifers numbers are present during winter and spring. During June and July, population increases and reaches 220 ind/l maximum. In August, num-bers sharply decline, followed by a second peak in September. Thereafter, numbers decrease again to winter levels in November. From east to west, rotifer abundance increases. Comparing Lake Ontario rotifers with those in other Great Lakes shows differences due to environmental conditions and zoogeographic distribution patterns. Rotifer biomass occasionally equals crustacean biomass, making rotifers an important secondary producer.

An oekogram displays important rotifer genera and different Kertella species relationships with respect to temperature and food conditions. (Danovich-

ALPINE LAKES IN KINGS CANYON NATION-AL PARK, CALIFORNIA BASELINE CONDI-TIONS AND POSSIBLE EFFECTS OF VISITOR

California Univ., Berkeley. Dept. of Forestry and Conservation.

G. Silverman, and D. C. Erman.

Journal of Environmental Management, Vol 8, No 1, p 73-87, 1979. 7 Fig, 3 Tab, 28 Ref.

Descriptors: \*Water quality, \*Limnology, \*Kings Canyon National Park(CA), \*Environmental effects, \*Mountain lakes, \*Recreation demand, Land use, Lakes, Water chemistry, Phytoplankton, Recreation, Alpine, Rainfall, Oligotrophy, Sierra Nevada Mountains, Camping, National parks, Bacteria, Plankton, Periphyton, Water supply.

Although current visitor use levels and restrictions appear adequate to protect lake quality in Kings Canyon National Park, California, the lakes remain canyon National Park, Cainforma, the makes remain extremely vulnerable to increased recreational demand. This summer 1975 study concentrates on two oligotrophic lake basins in the southern Sierra Nevada Mountain range: Rae Lakes, a popular undeveloped backcountry area, and Sixty Lakes, adjacent to Rae Lakes and at a similar elevation (1100 to 3400 m) but receiving considerable less. (3100 to 3400 m) but receiving considerably less visitor use. Phosphate concentrations are similar in vision use. Prospinate concentrations are similar in all lakes, usually ranging 6-14 micro g/l, with highest levels in early summer. While nitrate levels in Rae Lakes remain below eight micro/g/l, levels in Sixty Lakes are 50 micro g/l in July. Human input is not the primary cause of nutrient differ-

ences because peak nitrate concentrations occur prior to substantial human use. Average net phytoprior to substantial human use. Average net phyto-plankton density varies from zero to almost a mil-lion cells/1. Phytoplankton concentration is about two orders of magnitude greater throughout the Rae Lakes than the Sixty Lakes in July. Lower secchi disc transparency also occurs at Rae Lakes than at Sixty Lakes. Both nitrate and phytoplank-ton differences may be caused by geologic condi-tions of the lake basins. However, human impact may be partially responsible for the early high plankton densities and transparency decreases. Lake water is normally safe for drinking, however after precipitation, bacteria concentration increases in both lakes. (Danovich-Wisconsin) in both lakes. (Danovich-Wisconsin) W80-01116

ON THE MORPHOLOGY OF SUMMER ALGAE IN NON-STRATIFIED LAKES, Princeton Univ., NJ. Dept. of Civil Engineering. V. Van Nguyen, and E. F. Wood. Ecological Modelling, Vol 6, No 2, p 117-131, February 1979. 9 Fig, 16 Ref.

Descriptors: \*Mathematical models, \*Algae, \*Eutrophication, \*Lakes, Growth rates, Plant growth, Productivity, Phytoplankton, Biomass, Nutrients, Chlorophyll, Air temperature, Forecasting, Water pollution effects, Population, Equations, Stochastic processes, Light, Light intensity.

This paper develops a structural model for algae dynamics, within which is contained the elemen-tary cusp catastrophe, and which uses a geometric approach to lake eutrophication. The state equation contains the structure of a cusp catastrophe. The model framework accounts for a smooth or The model framework accounts for a smooth or abrupt growth rate. The long-term behavior of algae population, or the deterministic control parameter, is a composite of nutrient level and endogeneous respiration. The stochastic control parameter, or short-term behavior causing algae blooms and crashes, is a function of light influx and air temperature. The model notes that the collapse of temperature. The moder notes that the collapse of algae occurrs during heavy overcast weather following sudden cooling and not during hot calm periods as generally accepted. Field data for non-stratified prairie ponds tested the model and initial results show that the model is effective for predicting potential algae blooms and crashes. Quantitative and qualitative aspects of the developed model can be applied to management of lake systems. (Danovich-Wisconsin)

MULTIPLE REGRESSION MODELING APPROACH FOR REGIONAL WATER QUALITY

MANAGEMENT, Geological Survey, Portland, OR. nary bibliographic entry see Field 5A.

GROWTH AND COMPETITION OF THE MARINE DIATOMS PHAEODACTYLUM TRICORNUTUM AND THALASSIOSIRA PSEUDONANA. II. LIGHT LIMITATION, Woods Hole Oceanographic Institution, MA. Dept. of Biology, D. M. Nelson, C. F. D'Elia, and R. R. L. Guillard. Marine Biology, Vol 50, No 4, p 313-318. 1979. 3 Fig, 1 Tab, 26 Ref. NSF GB33288, OCE76-10876.

Descriptors: \*Diatoms, \*Light intensity, \*Competition, \*Limiting factors, \*Cytological studies, Phytoplankton, Laboratory tests, Aquiculture, Light, Dominant organisms, Growth rates, Habi-

Phaeodactylum tricornutum maintains higher divi-Phaeodactylum tricornutum maintains higher division rates than Thalassiosira pseudonana in laboratory culture tests characterized by either low silicic acid concentrations or low light intensities. This study was undertaken to gain further information on factors making aquiculture pond environments uniquely suitable for P. tricornutum-dominated phytoplankton development. In most cases, simply enriching nutrients with silicic acid does not produce conditions allowing T. pseudonana to mainduce conditions allowing T. pseudonana to main-tain itself with P. tricornutum in cultures. Under both 14:10 h LD cycle and continuous light, T.

pseudonana divides at higher rates than P. tricornutum at high light intensities; the reverse is true at intensities below 0.003 ly/min. In light-limited continuous cultures initially containing both species, P. tricornutum is unable to maintain itself at dilution rates greater than 0.52/day, while at dilution rates less than 0.52/day, P. tricornutum predominates. Comparisons with other mass cultured algae such as Skeletonema costatum, Chartoceros and Ditylum brightwellii, show T. pseudonana normally efficient, and P. tricornutum remarkably efficient, at maintaining cell division at low light intensity. (Danovich-Wisconsin)

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CHLOROPHYLL PRODUCTION, IN RE-SPONSE TO NUTRIENT ADDITIONS, BY THE ALGAE IN LAKE ROTORUA WATER, Department of Scientific and Industrial Research, Taupo (New Zealand). Freshwater Section. E. White, and G. W. Payne. New Zealand Journal of Marine and Freshwater Research Vol 12, No 2, p 131-138, June 1978. 1 Fig. 9 Tab, 10 Ref.

Descriptors: \*Chlorophyll, \*Nitrogen, \*Phosphorus, \*Limiting factors, \*Nutrient requirements, Lakes, Phytoplankton, Chemical analysis, Regression analysis, Laboratory tests, Phosphates, Nutrient loading, Algae, Eutrophication, Nutrients, Primary productivity, Lake Rotorua, New Zealand.

Chlorophyll production consistently increased along with added nitrogen in Lake Rotorua, New Zealand, but responses to additions of phosphorus Zealand, but responses to additions of phosphorus and trace elements were minor by comparison; indicating a persistent shortage of nitrogen in the shallow eutrophic lake which has mean depth of 10.5 m and area of 81 sq km. A secondary sewage treatment plant began operations in 1973. Nutrient load input quadrupled from the 1960's to the 1970's. Tertiary treatment is being considered; however, the nutrients which limit lake plant growth must be determined in order to decide which tertiary method can strin the wastewater of which tertiary method can strip the wastewater of the key nutrients. Batch cultures of both algae and the key nutrients. Batch cultures of both algae and water from Lake Rotorua surface waters and incoming streams were subjected to nitrogen, phosporus, and trace element additions, singularly and in combinations, at monthly intervals June 1975 to May 1976. Algal lakewater chlorophyll production from inorganic nitrogen alone was double the normal amount expected from reactive phosphorus concentrations. The nitrogen-to-phosphorus requirements would have been 40-1 to bring the predicted chlorophyll response to the observed value. A source of phosphorus other than the measured reactive amount was available to the phytoplankton. However, both phosphorus and the proven nitrogen are important nutrients in Lake phytopianiston. However, ooth phosphorus and the proven nitrogen are important nutrients in Lake Rotorus because a wide range of nitrogen-to-phosphorus ratios (4-35:1) increased chlorophyll production in stream water which flows into the lake. (Danovich-Wisconsin) W80-01120

TROPHIC STATUS OF TWENTY-ONE NEW ZEALAND HIGH COUNTRY LAKES, Cawthron Inst., Nelson, New Zealand.

M. J. Spencer. New Zealand Journal of Marine and Freshwater Research, Vol 12, No 2, p 139-151, June 1978. 4 Fig. 4 Tab, 23 Ref.

Descriptors: \*Lakes, \*Water quality, \*Trophic levels, \*Oligotrophy, \*Mesotrophy, \*Lake stages, \*Analytical techniques, New Zealand, Chemcical analysis, Eutrophication, Nitrogen, Phosphorus, Chlorophyll, Aquatic productivity, Dystrophy, Limnology, Nutrient loading, Bacteria.

Waters of high country lakes of South Island, New waters of high country lakes of South Island, New Zealand are generally of high biochemical quality. However, recent studies indicate some lakes have changed algal composition and nutrient loading. The main objective of this December 1975-March 1976 study was to obtain chemical and microbiolo-cial data. 21 Libra in themselves in since the gical data on 21 lakes in three major river water-sheds to establish relative trophic status. Lake size ranges from Lake Coleridge with 3290 ha and 200 m maximum depth to Lake Vagabond's Inn of 1.6

Effects Of Pollution—Group 5C

ha and 0.8 m maximum depth. Measurements were taken of the heterotrophic potential (v-max), or maximum rate of substrate uptake by heterotrophic microorganisms, bacteria, ATP, chlorophyll, pH, alkalinity, dissolved CO2, nitrogen compounds, total and soluble phosphorus, calcium, magnesium, and chloride. V-max is a good indicator of trophic levels because it correlates well with bacterial counts, soluble carbon, particulate carbon, and particulate nitrogen concentrations and is more sensitive than BOD measurements for discerning water quality effects of nutrient enrichments. The two largest deepest lakes have an average v-max of 0.002 micro g/1/hr indicating high oligotrophy. The trophic level of one lake was intermediate. The eight other oligotrophic lakes had an average area of 98 ha, maximum depth range of 10-40 m, and an average v-max of 0.017 micro g/1/hr. The five mesotrophic lakes had an average v-max of 0.031 micro g/1/hr and the five shallower mesotrophic lakes had an average v-max of 0.071 micro g/1/hr. (Danovich-Wisconsin)

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NUTRIENT CYCLING AND PRIMARY PRODUCTION IN PORT HACKING, NEW SOUTH

Commonwealth Scientific and Industrial Research Organization, Cronulla (Australia). Div. of Fisher-ies and Oceanography.

Australian Journal of Marine and Freshwater Research, Vol 29, No 6, p 803-815, 1978. 6 Fig, 18 Ref. B D Scott

Descriptors: \*Cycling nutrients, \*Oxygenation, \*Primary productivity, \*Thermal stratification, \*Port Hacking Estuary, Australia, \*Estuaries, Nutrents, Nitrates, Australia, Oxygen, Temperature, Water temperature, Phosphates, Silicates, Salinity, Stratification productivity, Regression analysis, Tidal effects, Density, Estuarine environments.

Oxygen consumption and nutrient regeneration in lower water columns of South West Arm in Port Hacking, Australia, correlates to density differences in the lower water column and to primary production. This 1975 investigation of Port Hackences in the lower water column and to primary production. This 1975 investigation of Port Hacking estuary examines temperature and salinity stratification in relation to primary production and dissolved oxygen, silicate, phosphate, and nitrate concentrations. Both temperature and salinity stratification periods are accompanied by deoxygeneration below 10 m. Apparent oxygen utilization (AOU) correlates to density differences below tidal exchange levels. Recent biodetritus originating from primary production causes deoxygenation; this is evident from relationships between AOU in the lower water column in stratification and deoxygenation periods. Silicate regeneration correlates to AOU with slight seasonal changes; during September to February, regenerated silicate to AOU ratio decreases, indicating small diatom propor tion to phytoplankton. Phosphate regeneration correlates to AOU. Nitrate regeneration correlates to AOU. Nitrate regeneration correlates to AOU. Nitrate regeneration correlates to AOU. The proposition of the pr

VEGETATION AND NUTRIENT STATUS OF NORTHERN MICHIGAN FENS, Michigan Univ., Pellston. Biological Station.

Canadian Journal of Botany, Vol 56, No 24, p 3044-3051, 1978. 2 Tab, 26 Ref.

Descriptors: \*Fens, \*Systematics, \*Plants, \*Biological communities, Michigan, Vascular tissue, Vegetation, Wetlands, Bogs, Peat, Water chemistry, Marsh plants, Ecosystems, Ecological distribution, Nutrients, Saturated soils, Water table.

Carex lasiocarpa is the most prevalent dominant plant and vegetation is relatively homogeneous in five fens in Cheboygan and Emmet Counties in northern Lower Michigan. This 1977 study examined fen vegetation and water characteristics to determine prevalent and dominant vegetation species, range of water chemistry conditions, and Juglum classification and nomenclature. The field layer dominates the vegetation stratum in all five fens while tree and shrub layers are absent or sparse. The field layer contains 85 vascular species with 30 vascular species/stand mean density. Other common dominants in decreasing importance are Carex aquatilis, Myrica gale, and Andromeda glau-cophylla. Common subordinates are Hypericum virginicum, Muhlenbergia glomerata, and Campanula aparinoides. Homogeneity index is 58%. Mean depth to water from soil surface varies 10 to 72 cm. Shallow groundwaters are minerotrophic with pH values ranging from 5.7 to 7.0, and 11.0 to 75.0 mg/1 calcium concentrations. Four fens are on floating mats with relatively stable water levels while the fifth is a grounded mat with substantial water level fluctuations from above ground to 72 cm below the surface. Consistent relationships between minerotrophic waters and fen vegetation occurs in nine separate Michigan peatlands. (Danovich-Wisconsin) vich-Wisconsin) W80-01123

EXPERIMENTAL STUDIES ON FACTORS LIMITING COLONIZATION BY DAPHNIA PULEX LEYDIG OF COASTAL MONTANE LAKES IN BRITISH COLUMBIA,

British Columbia Univ., Vancouver. Inst. of Animal Resource Ecology. W. E. Neill.

Canadian Journal of Zoology, Vol 56, No 12, p 2498-2507, 1978. 4 Fig, 5 Tab, 24 Ref.

Descriptors: \*Limiting factors, \*Food abundance, \*Daphnia, \*Ecological distribution, Zooplankton, Distribution, Lakes, Canada, British Columbia, Biological communities, Water quality, Predation, Invasion, Nutrients, Productivity, Mountains, Mountain forests, Aquatic environment.

Combined effects of water quality, food levies, and CHaoborus predation makes Daphnia pulex a marginal species in coastal montane lakes in British Columbia as compared to its abundant productivity in other North American lakes. Relatively small Columbia as compared to its abundant productivity in other North American lakes. Relatively small changes in food resource abundance or predator levels indicates D. Pulex colonization success or failure. Laboratory and field experiments were conducted in summer periods 1974-1975; factors including water quality, food supply, and predation by larval phantom midges upon species growth, survival and reproduction were examined. Montane lakes are generally small, nutrient poor, well-stratified in summer, oxygen rich, and deep. D. pulex juveniles reared in water from one typical lake survived but did not grow as well as those in coastal pond waters, even with comparable food abundances. Water quality, such as inorganic ions leaching from surrounding coniferous forests, is implicated. Both laboratory experiments and large-scale fertilizer manipulations in situ prove that D. pulex population growth is limited by scarce food resources. Reproduction, as well as juvenile growth and survival, are highly influenced by food concentrations. Daphnia rosea is a chief competitor in field experiments, contributing 75% of summertime seston grazing pressure. D. rosea juveniledeal with food limitations better than D. pulex juveniles. In laboratory experiments, CHaoborus trivittatus is a significant predator, however, modest fertilization levels enables D. pulex to outstrip predator abilities. (Danovich-Wisconsin) W80-01124

SEASONAL CHANGES IN PHYTOPLANKTON DENSITIES IN FOUR NORTH ISLAND LAKES, 1973-74, Department of Scientific and Industrial Research, Auckland (New Zealand). Botany Div.

V. Cassie.

New Zealand Journal of Marine and Freshwater Research, Vol 12, No 2, p 153-166, June 1978. 3 Fig, 4 Tab, 43 Ref.

Descriptors: \*Phytoplankton, \*Cyanophyta, \*Dominant organisms, \*Eutrophication, \*Indicators, \*Algal blooms, \*Algae, Rotorua Distric, New Zealand, Lakes, Seasonal, Fluctuations, Water quality, Plankton, Aquatic algae, Aquatic productivity, Trophic level.

This June 1973-May 1974 New Zealand study examined preserved material from phytoplankton populations from four lakes in the Rotorua District of North Island, New Zealand and used it to determine trophic levels. Each lake has its own distinctive species combinations and dominance patterns. Surface dominant diatoms and subsurface dominants are quite different. Dominance is considered in conjunction with species, quantity, and volume of cells present. Lake Rotoehu experienced a February bloom of Aphanizomenon floo-aquae, a blue-green alga toxic to cattle and fish. Osillatoria limosa, an alga indicative of polluted water, and Anabaena were also present. In April, dense blooms of Rhizosolenia eriensis and Melosira granulata was the dominant proposed prop

THE ANALYSIS OF NITROGEN FORMS IN WATERS AND WASTEWATERS, California Univ., Berkeley. Sanitary Engineering Research Lab. D. Jenkins. Progress in Water Technology, Vol 8, No 4-5, p 31-53, 1977. 4 Fig. 11 Tab, 51 Ref.

Descriptors: \*Nitrogen, \*Literature survey, \*Chemical analysis, \*Laboratory tests, \*Analytical techniques, Waste water, Ammonia, Distillation, Inorganic compounds, Reduction(Chemical), Testing procedures, Quality control, Organic compounds, Nitrites, Nitrates, Colorimetry, Digestion, Spectrophotometry, Polarographic analysis.

Current analytical methodologies for determining total, organic, ammonia, nitrite, and nitrate nitrogen is reviewed. The Kjeldhl digestion method is used to compute total nitrogen. The greatest problem occurs in low values less than 200 microg/l. A blank value is caused by sulfuric acid in the digestion mixture. The amount of organic nitrogen equals the difference between total nitrogen and an ammonia determination. Ammonia nitrogen methods include protonated ammonium ion or aqueous ammonia wet chemical analyses. Satisfactory methods are available for various concentrations of ammonia ranging from 50 micro g/l to 30 mg/l. A borate buffer is recommended for the ammonia distillation process. Measurements from nitrite from one micro g/l to two mg/l do not present analytical difficulties from either a sensitivity of interference viewpoint. Techniques used are diazo-interference viewpoint. analytical difficulties from either a sensitivity of interference viewpoint. Techniques used are diazotization followed by coupling of the azo-compound at low pH. Nitrate determinations are the most difficult and have the greatest number of interferences. UV spectrometry, polarography, specific ion electrodes, and colorimetric methods are used. The latter method has disadvantages in performance, convenience of conduct, or interferences with nitrate in the 0.1-10 mg/l range. Excellent methods exist for analyzing very high nitrate levels, greater than five mg/l, and for very low nitrate levels, less than 0.5 - 1 mg/l in both fresh and saline waters, however, a technological gap exists for analyzing intermediate levels. (Danovich-Wisconsin) Wisconsin) W80-01127

NITROGEN IN ORGANIC MATTER AND FER-TILIZER AS A SOURCE OF POLLUTION.

#### Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

## Group 5C-Effects Of Pollution

Institute for Soil Fertility, Groningen (Nether-G. J. Kolenbrander

Progress in Water Technology, Vol 8, No 4-5, p 67-84, 1977. 8 Fig. 4 Tab, 57 Ref.

Descriptors: \*Nitrogen, \*Water pollution sources, \*Fertilizers, \*Manure, \*Organic wastes, \*Leaching, Literature survey, Farm wastes, Volatility, Legumes, Seepage, Organic compounds, Crop production, Nitrification, Denitrification, Nitrogen cycle, Leachage, Nitrates, Drainage, Soils.

Replacing organic nitrogen sources partially by mineral fertilizer nitrogen will reduce losses by leaching and denitrification. Limiting nitrogen fertilizer consumption reduces nitrogen losses but also reduces crop production. Denitrification takes place mainly in the rooting zone and conditions for denitrification are more favorable with increasing centrincation are more avorable with increasing soil heaviness, which reduces water percolation velocity and promotes anaerobic conditions after rainfall in the upper soil layers. There is normally enough energy for denitrification to occur. On light sandy soils, nitrogen leaching increases with increasing organic nitrogen inputs. At least 50% of increasing organic nitrogen inputs. At least 30% of the fertilizer applied is recycled into organic nitro-gen by way of green manure, plant residues, and animal and human products. Dilution is the most important process in managing ground water qual-ity. World use of nitrogen fertilizers to enhance crop production has been increasing. But fertilizers crop production has been increasing. But fertilizers are serious pollutants to surface waters, causing eutrophication in lakes, and to ground water supplies, posing health hazards to humans and livestock. This paper also addresses two environmental concerns: how much nitrate losses by leaching from the rooting zone can be reduced, and the volatization energy needed in subsoil for the biological reduction of nitrates which has been washed out of the rooting zone. Nitrogen availability to crops nitrogen losses by leaching, volatization, and crop removal, and nitrogen losses in the subsoil by seepage and denitrification are also examined. (Danovich-Wisconsin)

MICROBIAL TRANSFORMATIONS OF INOR-GANIC NITROGEN,

Water Pollution Research Lab., Stevenage (England).

H. A. Painter.
Progress in Water Technology, Vol 8, No 4-5, p 3-29, 1977. 1 Fig, 155 Ref.

Descriptors: "Nitrogen, "Inorganic compounds, "Microbiology, "Nitrogen cycle, "Nitrogen fixing bacteria, "Nutrient kinetics, "Cycling nutrients, Microorganisms, Literature survey, Nitrogen fixation, Ammonia, Biochemistry, Anaerobic bacteria, Aerobic bacteria, Cyanophyta, Dissolved oxygen, Denitrification, Nitrification, Sewage treatment. Agotobacter treatment, Azotobacter.

To establish which nitrogen transformations are occurring and their extent, or to achieve a nitrogen balance, isolation and enumeration of relevant or-ganisms must be augmented with determinations of concentrations and changes in amounts of the par-ticular chemical species of nitrogen. This literature survey reviews nitrogen transformations in natural waters and their importance in waste water treatment. Three main microbiological processes involve inorganic nitrogen: assimilation, dissimilation, and nitrification. Conversion of inorganic nitrogen to cellular components such as proteins and incleic acids takes place in all plants and microor-ganisms. Inorganic nitrogen makes use of the oxygen bound in compounds for respiration and it is involved with oxidation of compounds to pro-vide energy for synthetic reactions. These proces-es can affect the aqueous environment by amount oxidation of the processes and the provided of the processes and affect the aqueous environment by amount of the processes are affected to the processes and affect the aqueous environment by amount of the processes and a provided the processes are a few to the processes and a few to the processes are a few to the processes and a few to the processes are a few to the processes and a few to the processes are a few to the processes are a few to the processes and the processes are a few to the processes and the processes are a few to the processes and the processes are a few to the processes and the processes are a few to the processes and the processes are a few to the processes and the processes are a few to the processes and the processes are a few to the processes and the processes are a few to the processes and the processes are a few to the processes and the processes are a few to the processes and the processes are a few to the processes are a few to the processes and the processes are a few to the processes are a few to the processes and the processes are a few to the processes and the processes are a few to the processes and the processes are a few to the processes are a few to the processes and the processes are a few to the processes are a toxicity to fish, oxygen depletion by nitrification, and assimilation of nitrogen by algae causing eutrophication. Present physical-chemical methods of sewage treatment are much less efficient in removsewage treatment are much rises enheist in Femov-ing inorganic nitrogen than are the biological proc-esses. The most economically important reaction is autroptrophic nitrification. However, the nitrifica-tion rate in treatment processes is about half that in pure cultures. Considering biochemical processes, nitrogen removal from waste waters can be

achieved by either a completely separate, anaero-bic stage for denitrification or an alternating aero-bic-anaerobic mixed system. (Danovich-Wisconsin) W80-01129

THE INFLUENCE OF NITROGEN FERTILIZ-ERS ON STREAM NITRATE CONCENTRA-TIONS NEAR ALLISTON, ONTARIO, CANADA,

York Univ., Downsview (Ontario). Dept. of Geog-

A. R. Hill, and N. Wylie.
Progress in Water Technology, Vol 8, No 4-5, p 91-100, 1977. 2 Fig. 3 Tab, 12 Ref.

Descriptors: \*Fertilizers, \*Nitrates, \*Streams, \*Water pollution sources, \*Non-point sources, Canada, Lotic environment, Nitrogen, Groundwater, Agriculture, Farm wastes, Running wastes, Flow, Precipitation(Atmospheric), Surface runoff, Precipage Farms Drainage, Farms.

Although fertilizers have been applied extensively in the Alliston area, Simcoe County, Ontario, 1974 stream water samples show little evidence of significant fertilizer contribution to stream nitrate levels. High nitrate concentrations were observed in the tile drain discharge and in groundwater underlying heavily fertilized potato fields. Adjaunderlying heavily fertilized potato fields. Adja-cent rivers generally show low nitrate levels, except during major rises in discharge, when niexcept during major rises in discharge, when ni-trate concentrations increase in response to surface runoff from 0.46 mg/l to two mg/l and tile drain discharge up to 25 mg/l. Fertilizer consumption in the past 20 years has been increasing rapidly and was therefore thought responsible for the rising nitrogen levels in water bodies thus contributing to nitrogen levels in water obtaines thus contributing to the eutrophication problem. On a glacial sand plain, eight separate fields adjacent to the main regional streams were studied. Stream water sam-ples at 48 sites were collected weekly during 1974, April 21-August 31, then every three weeks Sep-tember-December. Nitrate nitrogen concentrations tember-December. Intrate introgen concentrations were measured by auto-analyzer; total nitrate and nitrate were determined by copper-cadmium reduction of nitrate to nitrite. Difficulties of evaluating the contribution of fertilizers to water pollution are noted, with the suggestion that such research should in the future be based on detailed sampling over a number of years. (Danovich-Wisconsin) W80-01130

COMPARISON OF KINETIC MODELS FOR THE SIMULATION OF ALGAL GROWTH, (Belgium).

Ghent Rijksuniversiteit (Belgium). Chemistry Lab. E. Van Vaerenbergh, and H. Paelinck.

In: Modeling, Identification and Control in Environmental Systems, p 635-647, 1978. 2 Fig, 4 Tab, 11 Ref. IFIP, North-Holland Publishing Company.

Descriptors: \*Plant growth, \*Algae, \*Artificial Descriptors: "raint growth, "Algae, "Artincias substrates, "Mathematical models, Plant growth substances, Kinetics, Substrates, Simulation analysis, Metabolism, Nitrates, Inhibition, Growth rates, Nutrients, Regression analysis, Orthophosphate,

Steady-state points of turbidostatically controlled semi-discontinuous algal cultures could not be treated as steady-state points of continuous cultreated as steady-state points of continuous cul-tures, therefore necessitating simulation of the cul-turing procedure. Biological processes have been widely applied recently. Algae have been used to study primary production, water purification, eu-trophication and algal blooms. In order to best use algal culture, knowledge and understanding of nu-trient metabolism and concordant mathematical models are needed. The regression for single limi-tations as tacquestate models. models are needed. The regression for single limitations as steady-state points of continuous cultures give reliable parameter values for growth, but inaccurate values for nutrient uptake. For phosphage nutrition, there is strong noncompetitive inhibition of growth due to uptake. Nitrate nutrition also reveals a substrate inhibition for uptake. This leads reveals a substrate infinition for uptake. In steads to a conclusion that the energy requirement is less for the uptake of nitrates than of phosphates. A linear relationship occurs between the residual and feed medium concentration. Nitrate experiments had a slope with a value of one in simulating the steady state points. The phosphate experiments had

a slope of 0.66, indicating that an unknown reaction was transforming and consuming the medium orthophosphate. The limits of the Nutrient-content of continuously cultured Scenedesmus were calculated at 11.79-2.26% for N and 3.890.24 for P. (Danovich-Wisconsin) W80-01131

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A DYNAMIC MODEL OF QUALITY OF RIVER WATER WITH CONSIDERATION OF NITRIFICATION PROCESS,

Kyoto Univ. (Japan). Dept. of Applied Mathemat-

Kyoto Univ. (Japan). Dept. of Applied Mathematics and Physics.

M. Shima, F. Delebecque, and N. Adachi.
In: Modeling, Identification and Control in Environmental Systems, p 511-526, 1978. 9 Fig, 10 Ref. IFIP, North-Holland Publishing Company.

Descriptors: \*Mathematical models, \*Rivers, \*Ni-trification, \*Equations, \*Self-purification, \*Oxygen sag, Water quality, Microorganisms, Nutrient cyng, Simulation analysis, Oxygen demand, Reaer-on, Lotic environment, Water pollution, Dissolved oxygen, Model studies.

Mathematical models and simulations are used to analyze self-purification processes in rivers. A second sag in the dissolved oxygen (DO) curve occurs for a wide range of parameter values in these processes. The nitrification-linked depth and duration of the low DO concentrations sag are mainly dependent on initial ammonium quantity, initial organic load discharged, maximum specific growth rate of Nitrobacteria growth limiting facinitial organic load discharged, maximum specific growth rate of Nitrobacteria, growth limiting factors, concentrations of DO and ammonium. Dynamics of nitrification and its effects on water quality are clarified and the biodegradation of organic material, nitrification, and reaeration processes are included. A dynamic model is constructed according to a modified monod model of microbiological reactions. The model is not intended for direct application to a real river but points out that the nitrification process is an essential element for any practical model simulating an actual long river. For example, this model helps explain extremely low Do concentrations seen at the lower reaches of the Seine River in France. The model also agrees with qualitative experimental results of Edeline and Lambert on river self-purification also agrees with quantative experimental results of Edeline and Lambert on river self-purification processes. This model exposes deficiencies of the Streeter-Phelps model, which assumes a first order reaction for the biodegradation of BOD and ne-glects the nitrification process. (Danovich-Wiscon-W80-01132

MODELS FOR PREDICTING WATER POLLU-TION FROM AGRICULTURAL WATER-SHEDS,

Science and Education Administration, Chickasha, OK. Southern Great Plains Watershed Research

In: Modeling, Identification, and Control in Envi-ronmental Systems, p 501-509, 1978. 17 Ref. IFIP, North-Holland Publishing Company.

Descriptors: \*Agricultural watersheds, \*Water pollution, \*Mathematical models, \*Model studies, Sediments, Salinity, Nutrients, Pesticides, Water pollution control, Water pollution sources, Runoff, Hydrologic data, Planning, Simulation analysis, Water quality, Watersheds(Basins), Hydrology.

Modelling as applied to agriculture-derived water pollutants attempts to describe water quality at some future time under specified conditions; this paper reviews current techniques. An agricultural chemical transport model was developed to predict concentrations and amounts of nutrients, pesticides, and sediments lost from farm-sized watercides, and sediments lost from farm-sized water-sheds. It combines the USDA hydrographic labo-ratory model for simulating hydrology, the Onstad-Foster model for erosion, and the Frer model for chemical transport. A hydrology model has been calibrated and tested on watersheds rang-ing from 9.1-40.7 sq km in size in four states. An agricultural runoff model includes subprograms in hydrology and is equivalent to the Stanford water-shed model. Hydrology, sediment, and pesticide subprograms have been tested; and the greatest

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Effects Of Pollution-Group 5C

deficiency is that tilling operations, which affect runoff and sediment loss, have not been included in the model. A nonpoint source pollutant loading model can handle larger areas with mixed land uses. The model was calibrated with data from three metropolitan area watersheds. A simplified planning hydrologic model is based on the curve number model (U.S. SCS) and the Universal Soil Loss Equation. It is used to predict overland flow and simulate the amount of soil and chemical loss by the input of weather records. (Danovich-Wisconsin) W80-01133

EUTROPHICATION MODELS, Royal Danish School of Pharmacy, Copenhagen. Dept. of Chemistry. S. E. Jorgensen. In: Modeling, Identification and Control in Environmental Systems, p 473-500, 1978. 3 Fig., 16 Tab, 56 Ref. IFIP, North-Holland Publishing Company.

Descriptors: \*Mathematical models, \*Equations, \*Model studies, \*Eutrophication, Light, Lakes, Regression analysis, Zooplankton, Phytoplankton, Nitrogen cycle, Ecosystems, Temperature.

Nitrogen cycle, Ecosystems, Temperature.

Stating goals is the first part of a strategy for setting up an ecological model to solve a specific eutrophication problem. The processes and state variables are obtained by listing relevant massflows and calculating system energy. After state variables are selected, a system dynamics flow diagram and the equations are set up. Next a sensitivity analysis is carried out, followed by model calibration using a set of observations from one or more ecosystems. Automatic calibration, which changes parameter values in response to the sensitivity analysis, is preferred. Finally, the model must be validated against an independent set of observations before it can be used as a predictive tool. The strategy of lake modeling is to build a model complex enough to give an acceptable description of the lake processes. The paper focuses on dynamic causally based models and reviews the following equations: phytosynthesis, light limiting expression, zooplankton grazing rates, settling, nitrogen fixation, denitrification, release of nutrients from the sediment, temperature effects upon biological rates, rate of exchange between epilimnion and hypolimnion, rate of exchange between water and atmosphere, detritus, and zooplankton respiration, excretion, and mortality. The symbols used in the equations, parameter values and stoichiometric ratios, all previously applied in several studies are reviewed. (Danovich-Wisconsin)

BENZO(A)PYRENE: STUDIES OF THE EF-FECTS OF THIS UBIQUITOUS POLLUTANT ON FISHES, University of Southern California, Los Angeles. Inst. for Marine and Coastal Studies. H. Puffer, K. Duncan, E. Von Hofe, and D.

Winkler.
In: 'Oceans '79', Fifth Annual Combined Conference of Institute of Electrical and Electronics Engineers and Marine Technology Society, held San Diego, California, September 17-19, 1979. p 398-400, 3 Ref. IEEE, New York, Publication No 79 CH 1478-70EC.

Descriptors: \*Industrial wastes, \*Water pollution effects, \*Oil pollution, Environmental effects, Sediments, Fish, Toxicity, Pollutants, \*Outer Continental Shelf, Petroleum industry, Hydrocarbons, Carcinogens, Benzo(a)pyrene(BaP).

Polycyclic aromatic hydrocarbons (PAH) are recognized environmental contaminants. The source of these carcinogenic pollutants are numerous including industrial effluent, petroleum spillage which accompanies offshore drilling, domestic waste, and the runoff of asphalt roads. PAH's have been found and measured in marine bottom sediments and in marine animals. Many of these compounds, particularly benzo(a)pyrene (BaP) and its metabolites, are known to be potent chemical carcinogens. Using harbor environmental levels as a guide, the following studies were undertaken: (1) acute toxicity and chronic tumor induction, (2)

BaP metabolism and distribution; and (3) effect on fecundity. (Sinha-OEIS) W80-01137

RESPONSE TO OIL SPILLS IN THE ARCTIC ENVIRONMENT: A REVIEW, Science Applications, Inc., Boulder, CO. Marine Environmental Science Div. B. Morson, and E. Sobey. In: 'Oceans' '79', Fifth Annual Combined Conference of Institute of Electrical and Electronics Engineers and the Marine Technology Society, held San Diego, California, September 17-19, 1979. p 407-414, 53 Ref. IEEE, New York, Publication No 79 CH 1478-70EC.

Descriptors: \*Environmental effects, \*Oil spills, \*Cold regions, \*Arctic, Sea ice, Water pollution, Resources development, Equipment, Personnel, \*Outer Continental Shelf.

A review is presented of the response techniques that are applicable to oil spills in Arctic conditions, onshore and at sea. The fate of oil in these environments is briefly discussed, and resource considerations for responding to oil spills are outlined. Currently available oil spill response techniques have limited effectiveness in the Arctic because of low temperatures, the presence of ice and snow, the long periods of winter darkness, and the inaccessibility of much of the arctic environment. These environmental conditions place severe constraints on both equipment and personnel. (Sinha-OEIS) OEIS) W80-01138

ENVIRONMENTAL IMPACT ASSESSMENT FOR OPERATIONAL OTEC PLATFORMS, Interstate Electronics Corp., Anaheim, CA. Oce-

Interstate Electronics Corp., Anaheim, CA. Oceanic Engineering Div.
M. D. Sands.
In: 'Oceans' '79', Fifth Annual Combined Conference of Institute of Electrical and Electronics Engineers and Marine Technology Society, held San Diego, California, September 17-19, 1979. p 546-547, 2 Ref. IEEE, New York, Publication No 79CH1478-7OEC.

Descriptors: \*Resources development, \*Energy conversion, \*Environmental effects, Water pollution effects, \*Outer Continental Shelf, Ocean Thermal Energy Conversion(OTEC), Environmental

As the Ocean Thermal Energy Conversion (OTEC) Program advances toward commercialization, the potential environmental impacts of large scale development must be assessed. Design modifications that will mitigate or reduce potentially adverse effects must be identified and incorporated into the design configurations. In the second phase of Interstate Electronic's OTEC Environmental Impact Assessment Program sponsored by the Department of Energy, the key issues associated with the deployment and operation of demonstration and commercial size plants are under evaluation. The impacts that may occur in the marine environment include: climatological consequences (carbon dioxide release); platform attraction; ocean water mixing (nutrient and thermal redistribution); organism impingement and entrainment; biocide release; working fluid leaks; cable implantation; and metallic ion release. (Sinha-OEIS)

MODELING OF OIL MIGRATION IN PUGET

MODELING OF OIL MIGRATION IN PUGET SOUND,
Science Applications, Inc., Raleigh, NC.; and National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab. J. Karpen, and J. Galt.
In: Oceans '79, Fifth Annual Combined Conference of Institute of Electrical and Electronics Engineers and Marine Technology Society, held San Diego, California, September 17-19, 1979. p 628-634, 8 Fig. 21 Ref. IEEE, New York, Publication No 79CH 1478-7 OEC.

Descriptors: \*Oil pollution, \*Model studies, \*Oil spills, \*Dispersion, Currents, Environmental ef-

fects, Water pollution effects, Washington, Winds, Migration, \*Outer continental shelf. Puget sound.

The oil migration is simulated with a mixed Lagrangian-Eulerian model. The movement of the oil is modeled with Lagrangian point masses or Lagrangian Elements (LE). Time dependent dispersion is applied to the individual LEs. Eulerian current and wind fields are used to advect the LEs. Several scenarios for hypothetical spills in the Straits and upper Puget Sound are shown. The model accurately predicted the migration of the diesel oil spill at Ancortes, Washington. The model is general enough so that submodels for currents and winds developed for other regions can be easily integrated into the simulation. (Sinha OEIS)

FIELD STUDY OF POLLUTANT MIGRATION IN THE VICINITY OF A COASTAL FRONT, Science Applications, Inc., Raleigh, NC. E. Waddell, J. Karpen, and P. Debrule. In: Oceans '79, Fifth Annual Combined Conference of Institute of Electrical and Electronics Engineers and Marine Technology Society, held San Diego, California, September 17-19, 1979, p 635-641, 11 Fig. 9 Ref. IEEE, New York, Publication No 79 CH 1478-7 OEC.

Descriptors: \*Baseline studies, \*Pollution, \*Migration, \*Coasts, \*Tidal waters, Resources development, South Carolina, Estuaries, Dispersion, \*Outer Continental shelf, \*Coastal fronts, \*Plumes,

Discharge of estuarine water onto the shelf can create plumes with limits defined by fronts. The associated density field can produce a circulation with flow toward the front and back down along a density interface. In a field study, made east of Hilton Head Island, SC, surface and dispersed pollutant simulators were released in the vicinity of such a front and tracked using aerial photographic techniques. Tracers tended to converge to the front at only a small portion (10%) of the front's migration velocity. Most fixed-frame tracer velocities resulted from tidal currents and plume growth. Wind effects caused divergence between aluminum ties resulted from tidal currents and plume growth. Wind effects caused divergence between aluminum chips and dyes. At times, wind shear moved aluminum across the front and against the convergent surface currents. When shear was weaker, luminum accumulated on a moving front. Dyes were subducted along the density interface. Within the plume, vertical mixing and resultant dispersion were probably due to stronger vertical gradients in horizontal velocity than found in the ambient velocity field. Exchange between plume and ambient water was often inhibited by the strong stable pycnocline. The long-term objective of the study is to assess the importance of such interfaces in regulating transport of pollutants, since convergence to assess the importance of such interraces in regulating transport of pollutants, since convergence zones have been known to capture and hold oil slicks and pollutants concentrated in surface films, and to transport some of this material down into the water column. (Sinha-OEIS)

W80-01141

SOUTHERN CALIFORNIA OUTER CONTI-NENTAL SHELF BASELINE STUDIES: INTER-CALIBRATION OF PARTICIPATING HYDRO-CARBON LABORATORIES, Science Applications, Inc., La Jolla, CA. Trace Environmental Chemistry Lab.; and California

Univ., Los Angeles. J. R. Payne, P. J. Mankiewicz, J. E. Nemmers, and

J. R. Payne, F. J. Mankiewicz, J. E. Nemmers, and R. E. Fordan. In: Oceans '79, Fifth Annual Combined Confer-ence of Institute of Electrical and Electronics En-gineers and Marine Technology Society, held San Diego, California, September 17-19, 1979, p 777-785, 1 Fig. 3 Tab, 9 Ref. IEEE, New York, Publi-cation No 79 CH 1478-7 OEC.

Descriptors: \*Baseline studies, \*Laboratory tests, \*Water pollution effects, \*Oil pollution, California, Monitoring, Calibrations, Quality control, \*Outer continental shelf, Southern california bight, Petroleum hydrocarbons, Pollution monitoring.

As part of the Bureau of Land Management's Outer Continental Shelf Baseline Program in the

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## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

## Group 5C-Effects Of Pollution

Southern California Bight, a total of five different Hydrocarbon laboratories were involved in the analytical effort to measure petroleum hydrocarbons in marine samples. In this paper, the results of intra and inter-laboratory calibration exercises are presented. These data demonstrate that comparaberesults can be generated by different environmental laboratories through careful adherence to established and cantrolled laboratory protocol and dililished and controlled laboratory protocol and dili-gent efforts to intercalibrate the laboratories through varied sample exchange. Clearly, contin-ued attention must be paid toward developing im-proved methodology for pollutant monitoring; however, data illustrate a significant improvement OCS programs to date. (Sinha - OEIS)

OFFSHORE OIL: ITS IMPACT ON TEXAS COMMUNITIES. VOLUME I - EXECUTIVE SUMMARY, Research and Planning Consultants, Inc., Austin,

Research and Planning Consultants, Inc. Report to the Texas Coastal Management Program, General Land Office of Texas, June, 1977. 69 p, 3 Fig, 2

Descriptors: \*Texas, \*Resources development, \*Environmental effects, \*Coasts, Economics, Ecosystems, Oil pollution, Water pollution effects, \*Outer continental shelf, Environmental effects.

The citizens of the coastal region of Texas are among those most immediately affected by oil and gas development in the Gulf of Mexico. Attempts have been made in the past to calculate the impacts of outer continental shelf development with simple or outer commenca since uceveropment with simple formulae. However, the problem is complex. This report attempts to bridge the gap between a sophis-ticated computer analysis of impacts and the readi-ly employed likely impacts. The volumes in this ly employed likely impacts. The volumes in this study provide an extensive data base. For example, the employment, land use, water use, tax revenue, government service cost, population, and other factors associated with incremental increases of OCS activities are given. So are reasonable ranges for production in the OCS, an inventory of existing facilities, a description of industry practices, and much more. Fiscal effects on impacted communicies have been foremyleted, but the descriptions of ties have been formulated, but the determination of social, environmental, land use, water and other impacts cannot be made so simply. This report presents a process by which such determinations can be made and that process can be used in the future as a guide to the analysis of specific OCS oil and gas activities in specific areas. (Sinha - OEIS) W80-01143

EVIDENCE OF ARGO MERCHANT CARGO OIL IN MARINE BIOTA BY GLASS CAPIL-ARY GC ANALYSIS,

NOAA National Analytical Facility, Seattle, WA. For primary bibliographic entry see Field 5A. W80-01144

IMPACT OF THE ARGO MERCHANT OIL SPILL ON MACROBENTHIC AND PELAGIC ORGANISMS,

Food and Agriculture Organization of the United States, Rome (Italy).

W. W. Kuhnhold. In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences.p153-179, 14 Fig. 3 Tab, 27 Ref.

Descriptors: \*Oil spills, \*Environmental effects, \*Water pollution effects, Resources development, Aquatic life, Benthos, Massachusetts, \*Outer continental shelf, Macrobenthos, Pelagic organisms, Argo merchant oil spill.

Abundance studies in benthic and pelagic communities including commercial fish species were done but did not suggest a major adverse impact. Zooplankton was, at some stations, fouled with oil. At some stations within the slick area and close to the margin lower densities of ichthyoplankton were

found; pelagic fish eggs of the only two species present were contaminated and found moribund to present were contaminated and found moribund to a high degree. Laboratory experiments with cod eggs and young larvae were conducted with a no 6 fuel oil to determine toxic levels of dissolved hydrocarbon concentrations. Very few of the fish examined, showed traces of Argo Merchant oil in stomach contents or muscle tissue. Prey-predator relationship seemed to have remained normal. Shortcomings in sampling methodology and evaluations are discussed. (Sinha - OEIS)

OIL SPILL BEHAVIOR IN ICE DURING THE 1977 BUZZARDS BAY OIL SPILL,

P. C. Deslauriers. P. C. Deslauriers. In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 198-215, 7 Fig, 2 Tab, 16 Ref.

Descriptors: \*Oil spills, \*Ice, \*Cold regions, \*Water pollution effects, \*Path of pollutants, Movement, Sea ice, Resources development, Environmental effects, \*Outer continental shelf, Pollutants

On January 28, 1977, the barge Bouchard no. 65 grounded, releasing approximately 81,150 gallons of No 2 home heating oil into Buzzards Bay, which was 90% ice covered. Field measurements and was 90% ice covered. Field measurements and observations were initiated at the spill site on January 29, and continued until February 25, when only negligible amounts of oil remained in the bay. This paper documents these findings and puts these results in perspective with present state-of-the-art of oil spill behavior in ice-infested waters. Most of the present data on oil pollution in ice-covered waters has been obtained from spills in static ice conditions. The Burgardt Pau, still, which cowaters has been obtained from spins in static icconditions. The Buzzards Bay spill, which occurred in moving ice, therefore merited special attention. Of particular interest was the initial transport of the oil under the ice, its concentration in the rafted ice, the interaction of the oil with the hummocks and pressure ridges, its spreading from concentrated pools on the surface of ice floes, its penetration into the snow and ice, the weathering of the oil, and its final transport by ice floes during breakup. By continuing to respond with study teams to 'spills of opportunity' in cold regions, knowledge of the behavior of oil spilled in these regions can be substantially improved, and our ability to properly prepare effective countermeasures will be greatly enhanced. (Sinha - OEIS) ures will t

WEATHERING ESTIMATIONS FOR SPILLED OIL FROM BOUCHARD NO 65, NOAA National Analytical Facility, Seattle, WA. W. D. MacLeod Jr., M. Y. Uyeda, A. J. Friedman, and P. Prohaska.

and P. Prohaska.

In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 217-228, 5 Fig, 2 Tab, 8 Ref.

Descriptors: \*Oil spills, \*Weathering, \*Water pol-lution effects, \*Evaporation, Analytical techniques, Ice, Snow, Dissipation, Massachusetts, Resources development, Environmental effects, \*Outer continental shelf, Fuel oil, Hydrocarbons

Eleven ice and snow samples collected in the vicinity of the No 2 fuel oil spill from the barge Bouchard No 65 (Buzzards Bay, Massachusetts, 1977) were analyzed for saturated and aromatic hydrocarbons by high resolution gas chromato-graphy. Similar analysis of samples from the Bougraphy. Similar analysis of samples from the Bou-chard No 65 cargo indicated that the aromatic hydrocarbon level was somewhat less than that of the No 2 fuel oil spilled from the barge Florida in 1969. Weathering of alkanes and arenes was esti-mated by comparing quantitative changes in these hydrocarbons relative to the cargo oil. The arenes exhibited greater percent losses than the alkanes. Losses generally correlated with exposure of samples to the atmosphere. Overall oil losses were estimated by taking a weighted average of the alkane and arene loss estimates. (Sinha - OEIS) W80-01147

FATE AND EFFECT OF BUNKER C OIL SPILLED BY THE USNS POTOMAC IN MEL-VILLE BAY - GREENLAND - 1977, Greenland Fisheries Investigations, Charlottenlund SINKI CALIF TION

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H. K. Petersen. In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 332-343, 5 Fig, 1 Tab, 7 Ref.

Descriptors: \*Oil spills, \*Weathering, \*Water pol-lution effects, \*Environmental effects, Water qual-ity, Evaporation, Microbial degradation, Pollutant identification, \*Outer continental shelf, \*Greenland, Petroleum hydrocarbons, Dissolution, Tank-

On August 5, 1977, 380 tons of Bunker C fuel oil were spilled in Melville Bay, off Northwest Greenland. Studies of its fate and effects were conducted land. Studies of its fate and effects were conducted shortly after the spill occurred. The primary weathering mechanisms were evaporation and dissolution. Alkanes up to n-C17, and substituted naphthalenes, were depleted as much as 50 to 100% after 15 days of weathering. Tar flakes were observed sinking into the water column 10 days after the spill. Increased values of petroleum hydrocarbons in the water column were found in the immediate vicinity of the spill. Microbial degradation of the oil did not occur during the first two weeks. No immediate effect on the zooplankton was observed, but ingested oil was found in copepods and amphipods. No oiled birds and seals were observed, but oiled seals have been reported by local hunters. Oil from the seals has been analysed, and the oil might be identical to the oil spilled from the Potomac. (Sinha - OEIS) the Potomac. (Sinha - OEIS) W80-01148

EFFECTS OF AN OIL SPILL ON SALT MARSHES AT HARBOR ISLAND, TEXAS. I:

For primary bibliographic entry see Field 2J. W80-01149

PHYSICAL ASPECTS OF THE OIL SPILL FROM THE SUPERTANKER 'METULA', Texas A and M Univ., College Station. R. W. Hann.

In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 355-363, 1 Fig, 5 Ref.

Descriptors: \*Oil spills, \*Environmental effects, \*Water pollution effects, \*Water quality, Beaches, Estuaries, Marshes, Intertidal areas, \*Outer continental shelf, Strait of Magellan, Tierra del Fuego,

The oil spill from the supertanker Metula, the world's second largest at the time, serves as an important laboratory since cleanup operations were not carried out. The oil is disappearing at varying rates at different locations on Tierra del Puego. The exposed coastline is hiding or dissipating the oil into the sea by wave turbulence, blowing the oil into the sea by wave turbulence, blowing sand, and deeper penetration into the beach. Beach detritus such as oiled kelp and kelp holdfasts, lumber and trash will probably be evidence of the spill for the longest time. In the estuaries and protected areas, the rate of change is much slower and confined to the aging and hardening of the oil by air exposure and deeper penetration into the sediments. Removal is evident only where greatest energy is exerted, i.e., high velocity flowing channels and exposed beach top areas. Some fossilized birds are still in evidence. Salicornia is beginning to recover and grow through some oil deposits where previous stalks were present. The magnitude of the Metula spill coupled with the absence of any cleanup activity has made the spill serve a valuable role as a test system to observe the recovery from a major spill. (Sinha - OEIS)

Effects Of Pollution-Group 5C

SINKING OF OIL IN LOS ANGELES HARBOR, CALIFORNIA FOLLOWING THE DESTRUCTION OF THE SANSINENA, University of Southern California, Los Angeles. Environmental Geology Program. R. L. Kolpack, R. W. Stearns, and G. L.

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ill serve a the recovR. L. KOIPACK, R. W. Stearns, and G. L. Armstrong.
In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 379-392, 8 Fig. 22 Ref.

Descriptors: \*Oil spills, \*Sedimentation, \*Sediment-water interfaces, Biodegradation, Environmental effects, Water pollution effects, Burning, Path of pollutants, Outer continental shelf, Los Angeles Harbor, Tankers.

Burning of the Bunker C fuel supply from the Sansinena following a fire and explosion aboard the vessel in Los Angeles Harbor on December 17, 1976 resulted in the sinking of residual material. Computer simulations of the fate of Bunker C exposed to high temperatures indicate that a loss of about 45% of the lower molecular weight material will increase the density of the remaining material so that it sinks rapidly in normal sea water. Subsequent modification of the remaining oil at the sediment/water interface by natural processes such as dissolution and biodegradation is extremely slow. The residence time of the sunken oil that remains in Los Angeles Harbor is therefore controlled primarily by the rate of burial by burrowing organisms and sediment accumulation. (Sinha OBIS)

THE IMPACT OF THE SANSINENA EXPLO-SION AND BUNKER C SPILL ON THE MARINE ENVIRONMENT, University of Southern California, Los Angeles. Inst. for Marine and Coastal Studies. D. F. Soule, M. K. Wicksten, J. K. Dawson, and

D. F. Soule, M. R. Michael, C. S. M. Oguri.
In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17, June 1978. Coordinated by American Institute of Biological Sciences. p 394-443, 31 Fig, 3 Tab, 19 Ref.

Descriptors: \*Oil spills, \*Water pollution effects, \*Water quality, \*Environmental effects, Water quality, California, Toxicity, Baseline studies, Sedi-ments, \*Outer Continental Shelf, Los Angeles

On December 17, 1976 the 70,000 ton tanker Sansinena exploded and burned in Los Angeles Harbor while refueling. The explosion and fire resulted in an estimated spill of 20,000 to 32,000 barrels of Bunker C fuel. Harbors Environmental Projects initiated studies on December 20 on the spread of the oil and its impact on biology and water quality at 24 stations. Studies by HEP at the step rovided a baseline from 1972 to December 1976. Intertidal areas evidenced the greatest impact. Benthic population decreased greatly through April but returned to normal by November 1, 1977. Benthic organisms correlated best with oil and grease concentrations in bottom waters rather than in surface sediments, until November when hydrocarbons rose but no longer were correlated (toxic). (Sinha-OEIS)

THE FATE AND WEATHERING OF SURFACE OIL FROM THE BRAVO BLOWOUT, Continental Shelf Inst., Trondheim (Norway).

Audunson.

11. Audunson. In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17, June 1978. Coordinated by American Institute of Biological Sciences. p 446-475, 18 Fig, 1 Tab, 14 Ref.

Descriptors: "Oil pollution, "Water pollution effects, "Dispersion, "Evaporation, Model studies, Environmental effects, Weathering, Water quality, Resources development, "Outer continental shelf, "North Sea, Dissipation, Norway.

A description of the drift spreading, dissipation and weathering of the oil on the surface following the Bravo blowout is presented. Simulation of the drift, spread and dissipation of the oil on the surface is compared to field data. The dissipation computations are based upon a simple one parameter budget model. Tidal currents are included in the drift (preseding), computations. The results of eter budget model. Tidal currents are included in the drift (spreading) computations. The results of the computations show fair agreement with the observations. Drift card releases and statistical computations are also presented which illustrate the fortunate timing of the spill with regard to coastal pollution. (Sinha - OEIS) W80-01153

THE EKOFISK BRAVO BLOWOUT, PETRO-LEUM HYDROCARBONS IN THE SEA, Institute of Marine Research, Bergen (Norway). O. Grahl-Nielsen. In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 477-487 A Eig.

Descriptors: \*Oil spills, \*Oil pollution, \*Water pollution effects, \*Water quality, Resources development, Environmental effects, Pollutant identification, Analytical techniques, \*Outer continental shelf, \*North Sea, Petroleum hydrocarbons, Ekofisk Bravo blowout.

The Ekofisk Bravo Blowout occurred the 22 of April, 1977. During seven and a half days before the well was capped approximately 20,000 tons of oil were released. Chemical, biological and physical oceanographic surveys were performed as well as special pollution investigations. One of the objectives was to study the spreading and distribution of petroleum hydrocarbons in the sea. The oil was present as oil-in-water emulsion and the analysis was carried out by gas chromatography with flame ionisation detection. With a mass spectrometer as detector on the gas chromatograph it was possible to identify and quantify alkylated naphthalenes, phenanthrenes and debenzothiophenes originaing from the blowout over a large area. Using the same aromatics it was possible to distinguish tar balls of Bravo oil from tar balls of other origin, and also to exclude the Bravo oil as the source of pollution in some water samples collected south of Ekofisk in June. (Sinha - OEIS)

PRESENCE AND SOURCES OF OIL IN THE SEDIMENT AND BENTHIC COMMUNITY SURROUNDING THE EKOFISK FIELD AFTER THE BLOWOUT AT BRAVO, Nalco Environmental Sciences, Northbrook, IL.; and Masspec Analytical Speciality Services Ltd., Stroud (England).

J. H. Johnson, P. W. Brooks, A. K. Aldridge, and S. J. Rowland.

S. J. Rowland.

S. J. Kowland. In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 488-513, 11 Fig, 4 Tab, 29 Ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Water pol-lution effects, \*Environmental effects, Sediments, Benthos, Pollutant identification, Analytical tech-niques, Resources development, \*Outer continental shelf, Hydrocarbons, North Sea, Norway.

NALCO Environmental Sciences, at the request of the Phillips Petroleum Company, has undertaken an extensive environmental study to define possible contamination of the aquatic ecosystem by oil released during the Bravo blowout. Sediment and benthic samples, collected during the first phase of this study from a 100 mile square grid centered around the Ekofisk platform, have been processed to their isolate hydrocarbon fractions. These were enablyzed by ass chromatography and ass chromaanalyzed by gas chromatography and gas chroma-tography/mass spectrometry to determine the presence of hydrocarbons attributable to Bravo crude. The analytical data obtained indicated hydrocarbons which could be linked to Bravo crude were present in the sediments and benthic samples at levels relatively low in comparison to hydrocar-

bons from other natural and manmade sources. (Sinha - OEIS) W80-01155

BIOLOGICAL MONITORING OF SEDIMENTS IN EKOFISK OILFIELD, Field Studies Council, Pembroke (England). Oil Pollution Research Unit.

Pollution Research Unit.

J. M. Addy, D. Levell, and J. P. Hartley.
In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 515-539, 23 Fig. 3 Tab, 5 Ref, Append.

Descriptors: \*Monitoring, \*Water pollution effects, \*Oil pollution, \*Sediments, Environmental effects, Resources development, Aquatic life, \*Quter continental shelf, North Sea, Ekofisk oil-

A biological monitoring scheme for the Ekofisk oilfield was initiated in 1973, based on intensive quantitative sampling of the benthic macrofaunal community close to the installations. Samples were taken with a 0.1 sq m grab and the biological material was screened with a 1 mm mesh. Sediment particle size analysis was carried out in all surveys, and hydrocarbon analysis of sediments from 26 stations was carried out in 1977. It is suggested that the observed changes in community structure are due to industrial activity in the area. Oil pollution and other factors such as mechanical disturbance and domestic waste are considered. An evaluation of this monitoring programme is presented. It is concluded that the methods used are adequate to detect and measure the spatial extent of changes which have occurred in the benthic macrofauna. (Sinha - OEIS)

THE EFFECTS OF THE EKOFISK BLOWOUT ON HYDROCARBON RESIDUES IN FISH AND SHELLFISH, Torry Research Station, Aberdeen (Scotland). K. J. Whittle, P. R. Mackie, J. Farmer, and R.

Hardy. In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 541-559, 6 Fig, 3 Tab, 9 Ref.

Descriptors: \*Oil pollution, \*Water pollution effects, \*Fish, Shellfish, Environmental effects, Resources development, \*North Sea, \*Outer continental shelf, Hydrocarbon residues.

Demersal fish were trawled in the Ekofisk area in May just after the Ekofisk Pravo well was capped and again some two months later in July. In addition, cages containing mussels were suspended in the water column near the bottom and recovered a few days later. The fish flesh was assessed for oily taints after cooking and samples of muscle and liver tissues were analysed for aliphatic and aromatic hydrocarbons. Although two samples of addock caught initially showed signs of tainting at a low level, no taint was detected two months later. On both occasions the alkane concentrations in muscle and liver remained very similar to those found some years earlier during a baseline survey covering the North Sea. In May, but not in July, some analyses of the gut contents showed the presence of oil residues. The tissue samples which were analysed for selected two-to five-ring aromatic components gave individual concentrations below one nanogramme. (Sinha -OEIS)

THE INFAUNAL BENTHOS OF PETROLEUM-CONTAMINATED SEDIMENTS: STUDY OF A COMMUNITY AT A NATURAL OIL SEEP, California Univ., Livermore. Lawrence Livermore

Lab.
R. B. Spies, P. H. Davis, and D. H. Stuermer.
In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institue of Biological Sciences. p 736-

#### Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

## Group 5C-Effects Of Pollution

755, 10 Fig. 4 Tab, 19 Ref.

Descriptors: \*Oil spills, \*Seepage, \*Sediments, \*Benthos, Environmental effects, Water pollution effects, Resources development, California, \*Outer continental shelf, Nothria-Tellina, Patiria miniata.

A diverse Nothria-Tellina assemblage exists in sediments containing 3,300 to 10,200 ppm of crude oil. Community changes over a two-year period are compared with those in a nearby non-seepage area. The faunas are similar, except for the high abundance of oligochaetes in the seep sediments. Several measures of community structure (diversity) indicate relative constancy between stations and seasonally. Several measures indicate relative less community stability at the seep station. and seasonally. Several measures indicate relative-ly less community stability at the seep station. Sediment ATP concentrations were 809 mg ml-1 in areas of active seepage but only 146 to 402 mg ml-1 in other areas, which supports our earlier hypothesis of trophic enrichment. The water-solu-ble fraction of Prudhoe Bay crude oil is slightly more toxic to the larvae of the starfish Patiria miniata than is the seep oil. The described chemical differences between these oils are related to possi-ble biological effects. (Sinha - OEIS) W80-01138

ESTIMATION OF EFFECTS FROM OIL ON INTERTIDAL POPULATIONS: EXPERIMENTAL PERTUBATIONS VERSUS NATURAL VARIATION

Marine Research Lab.
J. R. Vanderhorst, J. W. Anderson, P. Wilkinson,

and D. Woodruff.

and D. Woodruff.
In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 808-820, 6 Fig, 10 Ref.

Descriptors: \*Oil spills, \*Sediments, \*Water pollu-tion effects, Intertidal areas, Aquatic life, Environ-mental effects, Resources development, Evalua-tion, \*Outer continental shelf.

Two experimental approaches to the investigation of effects of oil on intertidal population processes were evaluated in terms of effort required to quantitatively estimate effects of specific magnitudes. One approach used trays of oil-contaminated seliment placed in the low intertidal zone and subsequently treated in laboratory tanks. Three poly-chaete and two bivalve species were evaluated. It chaete and two bivaive species were evaluated. It was concluded that quantitative studies would be feasible using the sediment tray approach but that the cost for high precision would be high. Quantitative studies with the bivaives using the sediment tray approach would be less expensive for given precision than would studies of polychaetes. (Sinha - OEIS) W80-01159

POTENTIAL LONG-TERM EFFECTS OF PRUDHOE BAY CRUDE OIL IN ARCTIC SEDIMENTS ON INDIGENOUS BENTHIC IN-VERTEBRATE COMMUNITIES.

ouisville Univ., KY. Dept. of Biology M. Busdosh, K. R. Dobra, A. Horowitz, and S. E. Neff et al.

Netl'et al. In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 856-874, 8 Tab. 41 Ref.

Descriptors: \*Sediment, \*Benthos, \*Oil pollution, \*Toxicity, \*Environmental effects, Water pollution effects, Resources development, Weathering, \*Toxicity, \*Environmental effects, Wa effects, Resources development, \*Outer continental shelf.

Laboratory and field experiments were performed to determine the potential toxicity of Prudhoe Bay crude oil to indigenous Arctic benthic invertebrates. Toxicity was measured as mortality and as brates. I OXICITY Was measured as mortanity and as sublethal behavioral changes in feeding, movement and burrowing activities. When sediment was contaminated with fresh Prudhoe Bay crude oil, burrowing activity of the amphipod Boeckosimus (=Onisimus) affinis was significantly reduced.

Weathering of the oil was monitored by gas-liquid chromatography. Given a choice, in laboratory studies with oil contaminated or uncontaminated sediment, the amphipods selectively burrowed into sediment, the amphipods selectively burrowed into the uncontaminated sediment. Exposure in experimental chamber to sediment contaminated with fresh oil also resulted in decreased movement and feeding activity during the month that the oil underwent initial weathering. Mortality rates were low for amphipods exposed to sediment contaminated with fresh or weathered oil. Behavioral changes in feeding and movement appear to be temporary and associated with the light hydrocarbons present in fresh crude oil. Inhibition of burrowing activities pensisted beyond the time of inibons present in fresh crude oil. Inhibition of burrowing activities persisted beyond the time of initial oil weathering. Recolonization of in situ oil-contaminated sediment was monitored for 30 weeks. Amounts of residual oil were quantified using spectrofluorometric methods. The benthic community recolonizing oil contaminated areas was significantly different in species composition from that in unoiled reference areas. Amphipods avoided recolonizing oil contaminated areas. The preference for burrowing in unoiled substrate appears to be reflected in the avoidance of oil contaminated sediment in benthic community studies. (Sinha - OEIS) W80-01160

ACCUMULATION OF PETROLEUM HYDRO-CARBONS IN A SALT MARSH ECOSYSTEM EXPOSED TO STEADY STATE OIL INPUT, Louisiana State Univ, Baton Rouge. Dept. of

Marine Science. C. S. Milan, and T. Whelan III.

In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 876-893, 4 Fig. 3 Tab, 31 Ref.

Descriptors: \*Oil pollution, \*Ecosystems, \*Environmental effects, Salt marshes, Water pollution effects, Estuaries, Resources development, Path of pollutants, \*Outer continental shelf, Petroleum hy-

Various biological components of a salt marsh ecosystem were examined for petroleum hydrocar-bon accumulation. A site that has been exposed to steady state oil input for 30 years was compared to two control sites from known pristine areas. Three two control sites from known pristine areas. Three components of crude oil were considered: saturated alkanes, cycloalkanes, and aromatics. Cycloalkanes and aromatics were found to be a better indicator of oil accumulation than the n-alkanes. Benthic organisms, oysters and mussels, demonstrated the greatest enrichment of petroleum hydrocarbons, while the resident, free-swimming Fundulus gradis demonstrated the least petroleum enrichment. A scheme for the fate of spilled petroleum in an estuarine environment is proposed. The major adsorption site was marsh vegetation. Subsequent formation of petroleum-laden detritus ancuent formation of petroleum-laden detritus ancuent formation. major adsorption site was marsn vegetation. Subsequent formation of petroleum-laden detritus appears to be the major transport mechanism of petroleum into the ecosystem. A fluorescence spectrophotometric technique is proposed, whereby the analysis of the total aromatic content of benthic organisms can be used for baseline data and monitoring studies after oil spills. (Sinha OEIS) W80-01161

ECOLOGICAL CONSEQUENCES OF PETRO-LEUM SPILLAGE IN PUERTO RICO,

Center for Energy and Environment Research, Mayaguez (Puerto Rico).

J. M. Lopez.

In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 895-

Descriptors: \*Oil spills, \*Oil pollution, \*Water pollution effects, \*Environmental effects, \*Coasts, \*Ecosystems, Sediments, Resources development, Puerto Rico, Mangrove swamps, \*Outer continental shelf, Coral reefs, Thalassia testudinum, Rhizo-thers mental. phora mangle.

In order to develop an approach that can aid in assessing the impacts of oil spills, a typical Puerto Rican coastal environment is viewed in terms of its major marine ecosystem: coral reefs, seagrass beds and mangrove forests. Case studies of oil spills in Puerto Rico have involved comparison of abundance and diversity of organisms and species in spill areas versus carefully-matched, similar environs in no-spill areas. The relative vulnerability of these ecosystems has been demonstrated. Coral reefs are least impacted owing to their sub-tidal nature and high energy situation. Beds of the seagrass Thalassia testudinum exhibit relatively minor short-term effects. This comparative approach has grass Thalassia testudinum exhibit relatively minor short-term effects. This comparative approach has shown, however, that oil coating of fringing stands of the red mangrove Rhizophora mangle and the associated intertidal communities of their prop roots impairs productivity and destroys the atroots impairs productivity and destroys the at-tached organisms. Oil becomes trapped and may not be retrieved or cleaned from the mangrove forest. Analysis by GC/IR of extracts from sedi-ments within the mangal have shown the abun-dance and persistence of petroleum hydrocarbons in correlation with the absence of benthic organ-isms four years after an oil spill. (Sinha - OEIS) W80-01162

GUIDELINES FOR SURFACE WATER QUAL-ITY VOL 1 INORGANIC CHEMICAL SUB-STANCES PREAMBLE,

Department of the Environment, Ottawa (Ontario). Water Quality Branch. S. W. Reeder. 1979, 21 p. 5 Tab.

Descriptors: \*Surface waters, \*Water quality, \*Water quality standards, \*Water properties, Pollutants, Water pollution control, Inorganic compounds, Water utilization.

This report is the introduction to a series of water quality guidelines, to be published in three volumes as they become available. Volume 1 deals with inorganic chemical substances, Volume 2 with organic chemical substances and Volume 3 with physical, microbiological and radiological characteristics. The guidelines provide information on the source, occurrence and forms of basic water constituents and pullutants. A maximum concentration stituents and pollutants. A maximum concentration of the constituent is specified for each water use public water supply, agricultural water supply, aquatic life, wildlife, aesthetics and recreation, and industrial, water supply for the food processing industry. These limits are based on up-to-date scientific information and each one is chosen according to the most sensitive use. Each volume contains a preamble report similar to the present one. A master table lists the objectives for each water use for each of the constituents presented in that volume. The master table will be amended as addivolume. The master table will be amended as adultional information is produced and issued. The preamble also discusses the limitations of water quality use-objectives and their application in water pollution control programs. Tables for each water use compare published information from various sources on surface water quality limits. W80-01165

GUIDELINES FOR SURFACE WATER QUALITY VOL 1 INORGANIC CHEMICAL SUBSTANCES CHROMIUM,

Department of the Environment, Ottawa (Ontario). Water Quality Branch.
M. C. Taylor, S. W. Reeder, and A. Demayo. 1979, 9 p, 1 Fig, 1 Tab, 62 Ref.

Descriptors: \*Chromium, \*Inorganic compounds, \*Surface waters, \*Water quality, Toxicity, Public health, Aquatic life, Widlife, Livestock, Irrigation water, Recreation, Industrial water.

A literature survey was carried out on the toxic effects of chromium and chromium compounds on effects of chromium and chromium compounds on human health, aquatic life, plants and livestock. The information is summarized in this publication. From it, maximum chromium concentrations in water at which toxic effects will not appear are

recommended. (WATDOC) W80-01166

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Effects Of Pollution—Group 5C

GUIDELINES FOR SURFACE WATER QUALITY VOL 1 INORGANIC CHEMICAL SUBSTANCES MERCURY, Department of the Environment, Ottawa (Ontario). Water Quality Branch. S. W. Reeder, A. Demayo, and M. C. Taylor. 1979, 16 p, 3 Fig, 3 Tab, 19 Ref, 1 Append.

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Descriptors: \*Mercury, \*Inorganic compounds, \*Surface waters, \*Water quality, Toxicity, Public health, Aquatic life, Widlife, Vegetation, Livestock, Irrigation water, Industrial water, Recrea-

A literature survey was carried out on the toxic effects of mercury and mercury compounds on human health, aquatic life, plants and livestock. The information is summarized in this publication. From it, maximum mercury concentrations in water at which toxic effects will not appear are recommended. (WATDOC) W80-01167

GUIDELINES FOR SURFACE WATER QUAL-ITY VOL 1 INORGANIC CHEMICAL SUB-STANCES CADMIUM, Department of the Environment, Ottawa (Ontar-io). Water Quality Branch. S. W. Reeder, A. Demayo, and M. C. Taylor. 1979, 19 p., 144 Ref.

Descriptors: \*Cadmium, \*Inorganic compounds, \*Surface waters, \*Water quality, Toxicity, Vegetation, Public health, Aquatic life, Wildlife, Livestock, Sediments, Irrigation water, Industrial water, Recreation.

A literature survey was carried out on the toxic effects of cadmium and cadmium compounds on human health, aquatic life, plants and livestock. The information is summarized in this publication. From it, maximum cadmium concentrations in water at which toxic effects will not appear are recommended. (WATDOC) W80-01168

A CHAMBER FOR IN SITU EVALUATIONS OF PERIPHYTON PRODUCTIVITY IN LOTIC

Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
J. J. Rodgers, Jr., K. L. Dickson, and J. Cairns, Jr.
Archiv fur Hydrobiologie, Vol 84, No 3, p 389398, November 1978. 4 Fig, 1 Tab, 27 Ref. ERDAE(40-1)4939.

Descriptors: \*Periphyton, \*Productivity, \*Testing, \*Equipment, \*Measurement, \*Laboratory equipment, Algae, Photosynthesis, Instrumentation, Virginia, Evaluation, Analytical techniques, Testing procedures, Benthic flora, Primary productivity, Lotic environment, Currents(Water).

After a year of intensive use, a test chamber for insitu periphyton primary productivity measurements in lotic systems still functioned and needed only minor repairs. The chamber incorporates an internal variable-speed pump to insure mixing and is constructed of sturdy inexpensive materials. Pump operating range corresponds to 0.062 to 0.187/min turnover rates. Twelve light and dark chambers were tested August to November 1975 with pumps running (simulated flowing) and pumps disengaged (static) in New River at Glen Lyn, Virginia. Carbon assimilation measurements were significantly greater in simulating flowing chambers (25-20 mg C/sq/m/h) as compared to static nonflowing chambers (14-10 mg C/sq/m/h). From no-flow to 120 ml/min volumetric flow rates, primary productivity increases 31%. Maximum photosynthesis rates are achieved at 240 ml/min volumetric flow rate (0.124/min turnover rate). Carbon assimilation results are linear with time. Chamber oxygen concentration remain high during field tests; light chamber laboratory tests are 98.8% oxygen saturated after 4h and supersaturated at experiment termination, experiments in dark chambers reduce oxygen concentrations from 94.2 to 71.3% saturation. In-situ incubation is advantageous because it incorporates differences in light, temperature, and other environmental fac-

tors. Varying flow in chambers allows more realistic primary production estimates since current is a governing factor. (Danovich-Wisconsin) W80-01173

ENVIRONMENTAL IMPROVEMENT AT NER-OUTSOS INLET, B. C. VOLUME 1 SUMMARY

REPORT, Rayonier Canada (B.C.) Ltd., Port Alice. For primary bibliographic entry see Field 5A. W80-01192

ENVIRONMENTAL IMPROVEMENT AT NER-OUTSOS INLET, B.C. VOLUME 2 WATER QUALITY AND BIOLOGICAL STUDIES IN NEROUTSOS INLET, B.C. ITT Rayonier Inc., Shelton, WA. Olympic Re-

For primary bibliographic entry see Field 5B. W80-01193

ENVIRONMENTAL IMPROVEMENT AT NER-OUTSOS INLET, B.C. VOLUME 4 ASSESS-MENT OF SHORELINE REHABILITATION AT THE PORT ALICE PULP MILL,

Victoria Univ. (British Columbia). Dept. of Biology. D. V. Ellis, S. F. Cross, K. Coates, and S.

Mckinnell.

Rayonier Canada, Port Alice, British Columbia, 1978, 91 p, 19 Fig, 10 Tab, 8 Ref, 5 App.

Descriptors: "Pulp & paper industry, "Pulping wastes, "Marine benthos, Water Quality, Neroutsos Inlet, Vancouver Island, Water pollution effects, Industrial wastes, Port Alice, Estuaries, Monitoring, Animal populations, Oligochaetes, Amphipods, Marine algae, Intertidal areas, "Shoreline biology, Food chain, Periphyton, Diatoms.

The Marine Environmental Group at the University of Victoria is developing an array of tests to monitor rehabilitation on shore around the Port Alice pulp mill. Three tests have been developed and implemented in 1978. They comprise species associational analyses of gammaridean amphipods and enchytraeid oligochaetes, and shoreline colour photographic recording supported by biological surveys. These tests show that subtle impacts on shoreline biology presently extend throughout Neroutsos Inlet some 15 km from the mill, although major changes in the natural ecosystem are restricted to within 5-6 km of the mill. At the 2 km distance normal dominant mid-tide level rockweed(Fucus) growth begins to disappear with its contributions to primary production and shelter its contributions to primary production and shelter for epifauna, and is replaced by a higher elevation green filamentous Enteromorpha sheltering far less epifauna. At a distance of 300 metres from the mill epifauna. At a distance of 300 metres from the mill there is a further major reduction in the ecosystem as Enteromorpha is replaced by 'slimes' of filamentous algae, Ulothrix and Oscillatoria, a biologically abnormal amphipod population consisting of uniformly small and evenly dispersed beach fleas (Orchestia traskiana) and a reduced Enchytraeid population of one species only (Lumbricillus lineatus). (Katz-EIS) W80-01194

ENVIRONMENTAL IMPROVEMENT AT NER-OUTSOS INLET, B.C. VOLUME 5 MIGRA-TORY STUDIES OF JUVENILE SALMONIDS IN UPPER NEROUTSOS INLET, 1978, Beak Consultants Ltd., Vancouver (British Colum-

For primary bibliographic entry see Field 5A. W80-01195

ENVIRONMENTAL IMPROVEMENT AT NER-OUTSOS INLET, B.C. VOLUME 6 ACUTE AND CHRONIC EFFECTS OF PORT ALICE SUL-FITE MILL EFFLUENT TO FISH, E.V.S. Consultants Ltd., Vancouver (British Co-

G. Vigers, W. Cave, and R. Janssen. Rayonier Canada, Port Alice, British Columbia, Canada, 1978, 59 p, 23 Fig, 26 Tab, 33 Ref.

Descriptors: Bioassay, Laboratory tests, Mortality, Fish behavior, \*Salmon, Fish migration, \*Pulp & paper industry, \*Pulping wastes, Water quality, Neroutsos Inlet, Vancouver Island, Water polition effects, Industrial waste, Port Alice, Chum salmon, Herring, Biomass, Rainbow trout, Coho salmon, Juvenile fish, Growth, \*Sulfite pulping

The overall objective of this study was to determine the acute and chronic effects (lethality, avoidance and growth) of the Port Alice sulphite mill effluent (SME) through a program of field and laboratory studies. This study showed that 'end of pipe' toxicity and chemical data on the major mill outfalls can be related to concurrent in situ survival outfalls can be related to concurrent in situ surviv-al and avoidance bioassays using preference/avoid-ance chambers with juvenile chum, herring anu coho smolts as test organisms. It was found that the effects of SME extended predominantly North of the outfall locations. In the vicinity of the mill where SME is present at a high concentration in the surface water, the juvenile fish preferred sub-surface water, and substantial mortality was en-countered up to 1/4 to 1/2 mile from the mill outfalls in the preference/avoidance chambers. From these distances to beyond 1 1/4 miles from the mill outfall, mortalities were reduced or nonex-istent, although a preference for subsurface waters the mill outfall, mortalities were reduced or nonexistent, although a preference for subsurface waters was still observed. Beyond a half mile from the outfalls, fish increasingly preferred the surface meter of the water. Laboratory studies utilizing juvenile chum demonstrated effects of SME on growth at concentrations. The concentrations of SME used in the growth studies were related to the acute lethal toxicity at the 'end of pipe', and based on theoretical dilution factors which would be required to reach the levels of SME used in the growth studies, a postulated zone of influence was growth studies, a postulated zone of influence was constructed showing the maximum extent of ob-served effects. (Katz-EIS) W80-01196

EMBRYO-LARVAL TOXICITY TESTS WITH ORGANIC COMPOUNDS,
Thomas Hunt Morgan School of Biological Sciences, Lexington, KY.
For primary bibliographic entry see Field 5A.
W80-01197

PRODUCTIVITY AND ABUNDANCE OF ULTRA-AND NANOPLANKTON IN OSLOF-

JORDEN, Oslo Univ., Oslo (Norway).

Oslo Chiv., oslo (Not way). J. Throndsen. Sarsia, Vol 63, No 4, p 273-284, 1978. 7 Fig, 5 Tab, 25 Ref.

Descriptors: \*Productivity, \*Nannoplankton, \*Fjords, \*Oslofjorden, Norway, Plankton, Primary productivity, Growth rates, On-site investigations, On-site data collections, Diatoms, Chlorophyll, Aquatic productivity, Aquatic microorganisms.

Aquatic productivity, Aquatic microorganisms.

This April 1972-August 1974 investigation of six stations in Oslofjorden, Norway, assesses the primary production and importance of nannoplankton and ultraplankton by means of laboratory and insitu incubations. Production per unit water surface per year varied by a factor of 100 in the outer fjord and 300 in the inner fjord. Primary production values were up to five times greater in the inner part than the outer part. Summer daily production was 2.8 g C sq m (inner fjord) and 0.6 g C sq m (outer fjord). Sampling frequency was every five weeks and plankton passing through a five micro m mesh were termed ultraplankton and those passing a 45 micro m mesh, nannoplankton. Small seasons. Skeletenoma costatum, an important fjord species, appeared in all size fractions and Micromonas pusilla was an abundant ultraplankton species. Primary production was mostly confined to the uppermost 2-4 m. Using laboratory measurements, the ultraplankton fraction contributed about half the total surface water primary production, varying between 15 and 89%. In-situ relative measurements for nanoplankton ranged 14% to 100% primary production per sq m. Ultraplankton contributed about 14 and 91mg C sq m h (or 5% and 32% of the total). Ultraplankton minima both years

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

# Group 5C-Effects Of Pollution

occurred in March and was clearly related to the spring bloom of chain-forming net plankton diatoms. (Danovich-Wisconsin)

#### 5D. Waste Treatment Processes

THROTTLE SHAFT FOR THE CONTROLLED DISCHARGE OF DAMMED-UP WATER, Schulze (Oswald) G.m.b.H. and Co., KG. (Germany, F.R.). (Assignee). . Jakobi.

W. Jakobi. U.S. Patent No 4,151,859, 8 p, 4 Fig, 10 Ref; Official Gazette of the United States Patent Office, Vol 982, No 1, p 88-89, May 1, 1979.

Descriptors: \*Patents, \*Waste water treatment, \*Sewage treatment, \*Flow control, Reservoir releases, Sewerage, Flow system, Equipment.

The throttle shaft for the controlled discharge of dammed-up water, especially for the controlled flow of sewage and waste water to sewage-processing units, comprises a housing formed with an inlet and an outlet for a float-controlled throttle flap at the inlet regulating the flow of water into the housing is response to the water level therein. The housing is provided with a throttle channel for the water which connects with the outlet and is provided with an adjustable shutter shiftable between a fully closed and a fully ones position to tween a fully closed and a fully open position to vary the flow cross section of this channel or passage. (Sinha-OEIS) W80-00874

APPARATUS AND METHOD FOR REMOVAL OF SOLUBLE METAL IONS FROM AQUEOUS EFFLUENT,

London Lab. Ltd., Woodbridge, CT. (Assignee). J. F. Soltys, and H. L. Heard. U.S. Patent No 4,152,229, 8 p. 11 Fig. 7 Ref; Official Gazette of the United States Patent Office, Vol 982, No 1, p 208-209, May 1, 1979.

Descriptors: \*Patents, \*Waste water treatment, \*Water pollution treatment, \*Industrial wastes, \*Separation techniques, Metals, Electrolysis, Electrodes, Ion transport, Equipment, Galvanizing

A method for removal of soluble metals ions is A method for removal of soluble metals ions is provided by treatment of effluent by adjusting the pH to a reactive level which is highly acidic, and preferably between 2.0-3.5. The effluent is then passed continuously through the apparatus so that it flows through and in close contact with high surface area acceptor and donor electrodes which are in physical contact. Due to the galvanic action of these electrodes in contact with soluble metal ions in the effluent solution, the metal ions are ions in the effluent solution, the metal ions are plated onto the acceptor electrode and thereby removed from solution. The effluent then flows through an outlet which is positioned just below the level of the uppermost portion of the electrodes. The treated effluent then may be further treated or directly recycled into the environment, as may be desired. The apparatus comprises a chamber having an inlet and outlet to facilitate continuous flow. The electrodes are configured so as to expose a high surface area, preferably either as screens or expanded or perforated sheets of materials, thereby permitting maximum contact materials, thereby permitting maximum contact with the effluent. (Sinha-OEIS) W80-00876

BACKFLUSHING METHOD,

Clevepak Corp., White Plains, NY. (Assignee). A. E. Molvar. U.S. Patent No 4,152,259, 9 p, 8 Fig. 15 Ref; Official Gazette of the United States Patent Office, Vol 982, No 1, p 218, May 1, 1979.

Descriptors: \*Patents, \*Waste water treatment, \*Water pollution treatment, Industrial waste, Aeration, Turbulence, Mixing, Equipment, Pumps, Sewage, Backflushing.

A method utilizing a submerged system for efficiently mixing gas with waste water and for flushing accumulated debris from the system is described. Waste water is aerated by pumping through submerged tubes with openings through which air is drawn or pumped into the tubes to create turbulent mixing. Since submerged systems create turbulent mixing. Since submerged systems of this type normally pump a great volume of water, even a small number of particles in a large basin will eventually become lodged within the mixing chambers. These systems can be flushed of such debris by directly or indirectly connecting the inlets of each of the mixing chambers to which waste water is normally supplied for aeration to a higher, backflush location closer to or above water nigher, backflush location closer to or above water surface. If the pump is turned off while air continues to flow into the chambers, the difference in pressure between the water at the mixing chambers and the higher locations causes flow of the air backward through the inlets to that back-flush the sections. Glush the sections of the sections of the section of th location to flush the system. Surprisingly, the air pumps waste water at a substantial flow rate and pressure backward through the system. A separate line can be used with a valve to flush the debris directly above the surface where it can be collected. The waste water can be backflushed through the pump to clean the pump screen provided that the pump and its strainer are mounted above the mixing chambers. (Sinha - OEIS) W80-00878

FILTER FOR TREATMENT OF NATURAL AND WASTE WATER,

Leningrad Communal Agriculture Academy Research Inst. (USSR). search Inst. (USSR). Y. B. Lazovsky, and M. G. Novikov. U.S. Patent No 4,152,266, 8 p. 5 Fig. 7 Ref; Official Gazette of the United States Patent Office, Vol 982, No 1, p 220, May 1, 1979.

Descriptors: "Patents, "Waste water treatment, "Water treatment, Water pollution treatment, Water quality control, Water purification, Filtering, Filters, Equipment, Granular filters.

A filter for treatment of natural and waste water comprises a housing accommodating a granular filter body. A draining-distributing system is arranged within the lowermost bed of the filtering body. A system of ducts is mounted in the housing above the filtering body which provides positive distribution of water over the whole length of the filter. As a result of the uniform distribution of the water over the surface area of the filtering body, displacement and mixing of the gravel beds is precluded, and formation of unwashable zones in the filtering body is substantially prevented. (Sinha-OEIS)
W80-00881

METHOD OF TREATING ORGANIC WASTE

Marinaga Engineering Co. Ltd., Tokyo (Japan). K. Okada, H. Yamamoto, S. Teraguchi, and N. Ishibashi.

U.S. Patent No 4,153,544, 7 p, 1 Fig, 6 Tab, 4 Ref; Official Gazette of the United States Patent Office, Vol 982, No 2, p 649, May 8, 1979.

Descriptors: \*Patents, \*Waste water treatment, \*Water pollution treatment, \*Organic wastes, Aeration, Temperature, Activated sludge, Aerobic conditions, Nitrogen, Carbon.

A method of treating organic waste water in an aeration tank is characterized by the fact that (1) the dissolved oxygen content in the aeration tank is adjusted to be within the range of 1.5-4.5 ppm; (2) the temperature of the waste water is controlled to be within the range of 15-40C, and the residence time of the waste water in the aeration tank is set at ten or more days if the ratio of the total carbon content to the nitrogen content of the organic materials is not less than 5, and the temperature of the waste water is controlled to be within the range of 20-40C and the residence time of the waste water in the aeration tank is set at ten or more days if the ratio of the total carbon content to the nitrogen content of the organic materials is less than 5 and not less than 2.5; and (3) the activated sludge content in the aeration tank is kept constant by controlling the amount of COD to be removed. Sinha-OEIS)

PROCESS FOR CONTROLLING POLLUTION AND CONTAMINATION IN THE ELECTRO-DEPOSITION OF PAINT.

Nalco Chemical Co., Oak Brook, IL. (Assignee). S. W. Forney U.S. Patent No 4,153,548, 4 p, 4 Ref; Official Gazette of the United States Patent Office, Vol 982, No 2, p 650, May 8, 1979.

Descriptors: \*Patents, \*Waste water treatment, \*Water pollution treatment, \*Industrial wastes, \*Separation techniques, Chemical reactions, Filtration, Paints, Water reuse, Silica, Polymers,

Pollution and contamination in waste water, in-cluding drippings and wash water, from articles painted by electrodeposition are controlled by adding to the waste water an acidic silica sol and a water dispersible coagulating polymer in an amount sufficient to reduce the tackiness of the paint solids and thereby reduce the tendency of the paint solids and thereby reduce the tendency of the paint solids to adhere to surrounding surfaces and at the same time conditions the solids so that they can be readily removed from the water. The separation of the solids from the water can be effected by vacuum filtration and the filtrate can be used over again as a part of the water employed in the washing process. (Sinha-OEIS)

W80-00886

METHOD OF TREATMENT OF WASTE WATER CONTAINING SULFUR COMPOUNDS,

Hitachi Ltd. (Japan). (Assignee); Hitachi Plant Engineering and Construction Co., Ltd. (Japan). (Assignee); and Babcock-Hitachi K.K., Tokyo (Japan). (Assignee). K. Otani, S. Nishimura, T. Sawa, S. Kikkawa, and

N. Jiani, S. Janes, R. J. Shimokobe. U.S. Patent No. 4,154,673, 8 p, 6 Fig, 2 Tab, 9 Ref; Official Gazette of the United States Patent Office, Vol 982, No. 3, p. 1026, May 15, 1979.

Descriptors: \*Patents, \*Waste water treatment, \*Water pollution treatment, Industrial wastes, Separation techniques, Sulfur compounds, Ion exchange, Anion exchange, Regeneration, Thionic

Waste water issued from a wet type desulfurization Waste water issued from a wet type desulfurzation apparatus and containing thionic acid ions is introduced into ion-exchange towers filled with weakbasic anion-exchange which has to effect anion exchange therein. The weak-basic anion-exchange resin which has adsorbed the thionic acid ions is described by contacting an alkaling solution. The desorbed by contacting an alkaline solution. The tionic acid ions included in the desorbing solution are decomposed by heating them in the presence of acid. A decomposed solution is issued out of the system after its neutralization. (Sinha-OEIS) W80-00895

SKIMMER DEVICE,

L. T. Kole. U.S. Patent No 4,154,678, 7 p, 6 Fig, 14 Ref; Official Gazette of the United States Patent Office, Vol 982, No 3, p 1028, May 15, 1979.

Descriptors: \*Patents, \*Water pollution treatment, \*Water quality control, Oil pollution, Skimming, Pollutants, Equipment.

An apparatus for removing floatable material from the surface of water includes a hollow receptacle having a continuous side wall and a bottom having an opening centrally located. A pump is mounted within the hollow receptacle so that the pump inlet within the hollow receptacle bottom opening and the pump nuclet is connected to an exhaust conduit line mounted in the side wall and extending outwardly to a container or sump. The receptacle is positioned so that the top rim of the side receptacle wall rides at the surface of the carrier fluid or water so that floatable material, solid or liquid, is transferred over the rim into the receptainquio, is trainsterred over the rim into the recepta-cle. For solid materials, an opening is provided in the receptacle bottom for flowing upwardly into the receptacle to combine with the skimmed solid floatable substance for pumping outwardly of the receptacle through the exhaust conduit line. (Sinha-OEIS) W80-

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Waste Treatment Processes—Group 5D

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GRAVITY FLOW SEPTIC TANK SYSTEM, O. Marcotte. U.S. Patent No 4,154,685, 6 p, 4 Fig, 13 Ref; Official Gazette of the United States Patent Office, Vol 982, No 3, p 1030, May 15, 1979.

Descriptors: \*Patents, \*Waste water treatment, \*Water pollution treatment, \*Sewage treatment, Septic tanks, Domestic wastes, Biodegradation, Flow, Scum.

Flow, Scum.

The invention provides a septic tank system of greatly improved effectiveness in maintaining optimum bacterial action for a maximum length of time by utilizing series connected tanks with the water level in each successive tank being lower than that in the first tank so that gravity flow is established between the successive tanks. A transfer means is provided between each of the successive tanks comprising one or more horizontal pipes having their inlet ends closed, and each horizontal pipe having one or more horizontal slots formed in the wall at a level above the bottom of the pipe bore to permit the removal of scum through the slops in entrainment and/or suction action of the fluid flowing through the transfer pipe, thereby permitting gases to freely escape through the scum from the effluent surface of each tank and preventing the deleterious effects of trapped gases upon the biodegradation action normally produced in each successive septic tank. (Sinha-OEIS)

TREATMENT OF FULP MILL EFFLUENTS, Rhone-Poulenc S.A., Paris (France). (Assignee). B. Ancelle, and S. Lambert. U.S. Patent No 4,155,845, 4 p. 12 Ref; Official Gazette of the United States Patent Office, Vol 982, No 4, p 1415-1416, May 22, 1979.

Descriptors: \*Patents, \*Waste water treatment, \*Waster pollution treatment, Pulp wastes, Separation techniques, Filtration, Sodium compounds, Pulp and paper industry, \*Ultrafiltration.

Pulp mill effluents, particularly soda-containing treatment liquors, are subjected to a separatory treatment comprising a pre-treatment with flocculating agent in a sub-critical amount incapable of effecting flocculation, followed by an ultrafiltration of the pre-treated effluent. (Sinha - OEIS) W80-00902

VACUUM DRAINAGE SYSTEM, Electrolux G.m.b.H. (Germany, F.R.). (Assignee).

H. R. Michael.
U.S. Patent No 4,155,851, 5 p, 1 Fig. 9 Ref; Official Gazette of the United States Patent Office, Vol 982, No 4, p 1417-1418, May 22, 1979.

Descriptors: \*Patents, \*Waste water treatment, \*Sewage treatment, Water pollution treatment, Aeration, Sewerage, Equipment, Valves, Suction

A vacuum drain system includes a collecting tank and a sewage drain vacuum conduit line for con-veying sewage from service connections to the collecting tank under the influence of vacuum in collecting tank under the influence of vacuum in the system. Each service connection for admitting sewage includes a suction valve which also admits a volume of air to facilitate movement of sewage in the system. In order to prevent accumulation of sewage during prolonged periods of low usage of the system, such as at night, an auxiliary aeration system is provided for introducing a volume of air independently of the air admitted through operation of the suction valves. In order to control the proposed aeration arrangement in a desired manner, sensing devices are placed at suitable places along the vacuum line which produce a control signal whenever the water level in a rising section of the line reaches a certain level. (Sinha-OEIS)

PROCESS AND APPARATUS FOR REMOVAL OF IMPURITIES FROM LIQUIDS.

G. J. Nieuwenhuis. U.S. Patent No 4,156,647, 7 p. 3 Fig. 12 Ref; Official Gazette of the United States Patent Office, Vol 982, No 5, p 1692, May 29, 1979.

Descriptors: "Patents, "Waste water treatment, "Water pollution treatment, Industrial wastes, Heavy metals, Separation techniques, Filtration, Ion exchange, Adsorption, Equipment.

Ion exchange, Adsorption, Equipment.

This invention provides a unit for removal of impurities from liquids, the impurities generally present in small quantities, by contacting the liquid with a loose, particulate treating material which acts to remove the impurity from the liquid stream by reaction, by ion exchange or by adsorption. The treating material such as a naturally occurring polysaccharide polymer, is held in a vessel having a wall with multiple small openings, each filled with an inert, compact, finely-divided filter material. Means are mounted within the vessel to progressively sweep over the inzer surface of the wall just out of contact and over the openings in which the particulate filter material is retained to remove impurities lodged thereon and prevent blinding of the filter material by such impurities. The same means also acts to uniformlymix the particulate treatment material held within the vessel. The liquid with the impurities removed, because of the pressure differential between the inside and outside of the vessel, passes through the particulate filter material retained in the small openings of the vessel and is discharged from the housing surrounding the vessel. The treating material, once spent, is replaced as necessary. (Sinha - OEIS) W80-00909

FLOTATION DEVICE WITH PRETREAT-

MENT, Office of the Secretary of the (Navy), Washington,

Office of the Secretary of the (1847), Assumption, DC.

T. A. Kuepper.
U.S. Patent No 4,156,648, 7 p. 3 Fig. 12 Ref. Official Gazette of the United States Patent Office, Vol 982, No 5, p 1692-1693, May 29, 1979.

Descriptors: \*Patents, \*Water treatment, \*Waste water treatment, \*Water pollutiontreatment, \*Water purification, Separation techniques, Centrifugation, Coagulation, Flocculation, Filtration, Aeration, Ozone, Bubbles, Foam separation.

Methods and apparatus for treating water/wastewater to remove grit, suspended and colloidal solids of organic and inorganic nature, microorganisms and surfactants are described. Dense suspended solids (grit) are first removed by a centrifugation process. The influent water/wastewater is then passed through coagulation and flocculation chambers, an upflow clarifier and a high-rate setting chamber for final sedimentation. Next, the influent passes through a foam filter to remove colloidal particles. The water/wastewater under reatment is then pressurized and saturated with air and subsequently depressurized, causing the dissolved gas to bubble out of solution floating out suspended contaminants. At this point, ozone is introduced into the influent to create a thicker, more dense foam by oxidizing organic matter and more dense foam by oxidizing organic matter and for disinfection purposes. The foam floated to the surface of the influent is scraped off and furnishes the foam for the foam filter. (Sinha - OEIS)

GENERATION AND EVALUATION OF ALTERNATIVE PLANS FOR REGIONAL WASTEWAYER SYSTEMS: AN IMPUTED VALUE METHOD, Louisville Univ., KY. Dept. of Chemical and Environmental Engineering.

M. Nakamura, and E. D. Brill Jr. Water Resources Research, Vol 15, No 4, p 750-756, August 1979. 4 Fig, 3 Tab, 10 Ref.

Descriptors: \*Alternative planning, \*Evaluation, \*Waste water treatment, \*Branch-and-bound-method, \*Optimization, Methodology, Algorithms, Constraints, Mathematical models, Systems analysis, Equations, Regional systems, Cost minimization, Location problems, DuPage County(IL), Economic trade-offs.

A branch-and-bound method for use in planning regional wastewater treatment systems is extended to include a methodology for generating and evaluating alternative plans. Since many planning issues are related to a specific configuration of regional facilities, economic trade-offs among alternative plans are evaluated using imputed values of individual facilities or groups of them. The imputed values, or bounds on them are calculated from information contained in the branch-and-bound tree using an 'imputed value incidence matrix.' The general approach, which can be applied to other public facility location problems, is designed to aid an analyst in gaining more insights into the problem under study than obtainable from conventional optimization methods. The procedure is designed for use within a larger planning process where the steps are to generate, to evaluate, and to elaborate on alternative plans. The method is illustrated using the regional wastewater system for DuPage County, Illinois. (Bell-Graf-Cornell)

A STUDY OF THE IN-SITU INDIRECT FREEZ-ING PROCESS,
New Mexico Univ., Albuquerque. Dept. of Chemical and Nuclear Engineering.
For primary bibliographic entry see Field 3A.
W80-01006

A STUDY OF THE VACUUM-FREEZING HIGH PRESSURE ICE-MELTING PROCESS, New Mexico Univ., Albuquerque. Dept. of Chemical and Nuclear Engineering. For primary bibliographic entry see Field 3A. W80-01007

THE ANALYSIS OF NITROGEN FORMS IN WATERS AND WASTEWATERS, California Univ., Berkeley. Sanitary Engineering Research Lab. For primary bibliographic entry see Field 5C. W80-01127

AERATION METHOD AND SYSTEM, Clevepak Corp., White Plains, NY. (Assignee). A. E. Molvar. U.S. Patent No. 4,157,304, 9 p. 8 Fig. 11 Ref., Official Gazette of the United States Patent Office, Vol 983, No 1, p. 132, June 5, 1979.

Descriptors: \*Patents, \*Waste water treatment, \*Water pollution treatment, \*Aeration, Oxygen, Mixing, Bubbles, Turbulence, Equipment.

Mixing, Bubbles, Turbulence, Equipment.

The invention relates to an improved method and system for mixing a gas such as oxygen or air with waste water. The system includes mixing chambers which are placed below the surface of the waste water and through which the water is pumped from an inlet to an outlet. A suitable gas, such as oxygen or air containing oxygen, is injected into each of the mixing chambers at a step surface to form parallel streams of air and water in an extending chamber. As the two streams move down the extending chamber, the interface between the two streams becomes unstable and waves form which attach to the sides of the chamber. This causes large frictional stresses, creating tiny bubbles which mix with the water. Since the water and air essentially flow in the same direction, no energy is wasted in turbulence and the system is energy efficient. The mixing chamber is preferably tapered in the down stream direction, first gradually and then radically, to ensure that the vortices created by the mixing do not extend out of the chamber which would reduce the efficiency of the mixing. Further, helical vanes are preferably provided in the down stream direction, first gradually and then radically, to ensure that the vortices created by the mixing do not extend out of the chamber which would reduce the efficiency of the mixing. Further, helical vanes are preferably provided in the injection passages for the gas to create greater wave generating conditions which extend the operating range of the device to greater air flow rates. (Sinha-OEIS)

BIOLOGICAL WASTE WATER TREATMENT APPARATUS AND A METHOD OF PRODUC-ING THE SAME, Dengyosha Machine Works, Ltd., (Japan). (As-

# Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

## Group 5D-Waste Treatment Processes

signee). N. Yoshikawa, and R. Suzuki. U.S. Patent No 4,157,303, 7 p, 10 Fig. 5 Ref; Official Gazette of the United States Patent Office, Vol 983, No 1, p 132, June 5, 1979.

Descriptors: \*Patents, \*Waste water treatment, \*Water pollution treatment, Biological treatment, Microbial degradation, Equipment.

A waste water treatment apparatus includes broad surface areas of rotating assemblies for attaching microorganisms in spite of its short axial dimension to achieve the high performance of purification without increasing the driving power. The device comprises at least one rotating disc assembly rotatively driven while its lower halves are immersed in the waste water. Impellers are arranged in parallel side by side on a main shaft, and each impeller lel side by side on a main shaft, and each impeller comprises two parallel discs fixed to the main shaft, one of the discs being formed at its center with a suction opening and impeller blades radial to the main shaft between the two discs. The impeller is divided into a number of sectors consistence. impetier is divided into a number of sectors consisting of two sector side plates and two impeller blades which are integrally formed by blow molding and then arranged side by side to form a sector block. The thus produced sector blocks are then arranged about the main shaft and fixed to form a rotating disc assembly. (Sinha-OEIS) W80-01175

METHOD AND APPARATUS FOR TREATING LIQUID-CONTAINING SUBSTANCE MIXTURES, PARTICULARLY FIBRE SUSPEN-SIONS,

Sunds Aktiebolag, Sundsvall (Sweden). (Assignee). K. E. Bergstedt.

U.S. Patent No 4,157,302, 12 p, 14 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 983, No 1, p 131-132, June 5, 1979.

Descriptors: "Patents, "Waste water treatment, "Waster pollution treatment, "Pulp wastes, Cellulose, Separation techniques, Flow, Flow separation, Membranes, Equipment.

The invention related to a method and an appara-tus for separating liquid from mixtures of sub-stances, preferably fiber suspension such as cellu-lose pulp, particularly, in connection with washing or treatment of the suspension. The liquid-contain-ing substance flows in a first direction so that at ing substance flows in a first direction so that at least a portion of the liquid can be separated from the liquid-containing substance through the separating means. The liquid is withdrawn from the substance through the separating means in a second direction, intermittently interrupting the flow of the liquid downstream from the point of flow of the liquid downstream from the point of removal from the separating means so as to termi-nate the flow of the liquid and preventing the return flow of at least a portion of the separated liquid through the separating means. An apparatus is provided for directing the flow in the first direc-tion, separating means for separating at least a portion of the liquid in a second direction, means for interrupting the flow of a separated liquid at a point downstream of the separating means point downstream of the separating means and means for preventing the return flow of separated liquid through the separating means. Membranes are provided for preventing return flow of the liquid. The separating means comprises a screen member substantially parallel to the flow of the liquid in the first direction. The membrane is located on the downstream side of the screen member. (Sinha-OEIS) W80-01176

PROCESS FOR THE PURIFICATION OF PHENOL AND PHENOL FORMALDEHYDE CONTAINING WASTE WATER, Deutsche Gold- und Silber-Scheideanstalt A. G.,

Deutsche Gota- und Suber-scheideanstatt A. G., Frankfurt-am-Main (Germany, F.R.). (Assignee). H. Junkermann, and V. Hafner. U.S. Patent No 4,157,300, 8 p. 26 Ref; Official Gazette of the United States Patent Office, Vol 983, No 1, p 131, June 5, 1979.

Descriptors: \*Patents, \*Waste water treatment, \*Water pollution treatment, Industrial wastes, Chemical reactions, Phenols, Alkaline earth metals, Color, Formaldehyde.

Phenol or phenol-formaldehyde containing waste water is purified with chlorine dioxide by treating the waste water with alkali or alkaline earth metal chlorite in the presence of formaldehyde and the weight ratio of formaldehyde to phenol is between 0.5 to 2:1 and the mole ratio of the sum of phenol + formaldehyde to chlorite is between 1:1.2 to 1:2, whereupon the treated water is decolorized, in a given case in a known manner. (Sinha-OEIS)

WASTE WATER-TREATING METHOD,

Kureha Kagaku Kogy Kabushiki Kaisha, Tokyo (Japan). (Assignee); and Toyo Boseki Kabushiki Kaisha, Osaka (Japan). (Assignee).

Y. Amagi, and S. Inada. U.S. Patent No 4,159,244, 7 p, 2 Fig, 4 Tab, 9 Ref; Official Gazette of the United States Patent Office, Vol 983, No 4, p 811-812, June 26, 1979.

Descriptors: \*Patents, \*Waste water treatment, \*Water pollution treatment, \*Adsorption, Activated carbon, Flow, Particle size, Fluidized bed.

A waste water-treating method is provided which comprises passing an aqueous liquid, in an upward direction and at a suitable flow velocity, through a bed consisting of activated carbon whose particle diameter ranges between 0.20 and 1.5 mm and whose width of particle size range (or substantial difference between the largest ones and the smallest ones) is chosen to be 0.30 mm or more. The waste water is always made to contact the adsorption section of the fluidized bed. The linear velocity of the waste water is controlled so as to cause the expansion ratio of a fluidized bed of granular activated carbon to fall within the prescribed range. (Sinha-OEIS) A waste water-treating method is provided which W80-01178

METHOD FOR RECOVERY OF METALS FROM METAL PLATING BATHS AND NEU-TRALIZING TOXIC EFFLUENTS THERE-

Instytut Mechaniki Precyzyjnej, Warsaw (Poland).

(Assignee). F. Tuznik, and A. Lis

U.S. Patent No 4,157,942, 7 p, 1 Fig, 10 Ref; Official Gazette of the United States Patent Office, Vol 983, No 2, p 356, June 12, 1979.

Descriptors: \*Patents, \*Waste water treatment, \*Water pollution treatment, Industrial wastes, Metals, Separation techniques, Chemical precipitation, Filtration, Equipment, Water reuse, Chromium, \*Product recovery, Metal plating industry, Cyanida.

A method and apparatus for thorough neutraliza-tion of all plating bath solutions and effluents and for full recovery of used plating metals is provided. Hexavalent chromium is reduced to trivalent chromium with production of chromium hydroxide. Metals such as zinc and cadmium are recovered as Metais such as zinc and cadies, silver and copper are recovered as free metals. Additionally, the invention provides for neutralization of cyanide and chromic fumes exhausted from the reclaiming tanks. The pH of the reclaiming bath is adjusted from 3.0 to 13.0, and an aldehyde, and/or ozone, is introduced into the reclaiming bath. The fumes from the reclaiming tank are introduced into the from the reclaiming tank are introduced into the fume extraction ducts which carry the cyanide fumes in the form of hydrogen cyanide. Regeneration of the plating bath, the reclaiming bath, and the rinse water is effected according to conventional methods. The method and apparatus of the invention provide for disposal of all of the post-reaction solutions and rinse water effluents via the common decision action to the food by the common decision are to the food by the decision and the common decision action to the food by the common decision action to the common decision action action to the common decision action to the common decision action action action to the common decision action reaction solutions and rinse water effluents via the common drain system to the final pH-adjustment unit. By the time the effluent reaches the drain system, the effluent is free of cyanide and hexavalent chromium as well as of heavy metals. As filtration and purification of the plating bath, the reclaiming bath, and the rinse water are carried out within the closed-loop system, consumption of fresh water is reduced to 2-10% of the amount required in present systems. (Sinha-OEIS) W80-01181

# COMBINED WASTE WATER CLARIFICATION AND TRASH DISPOSAL SYSTEM,

N.A. H. Borst. U.S. Patent No 4,157,961, 17 p, 9 Fig. 12 Ref; Official Gazette of the United States Patent Office, Vol 983, No 2, p 361, June 12, 1979.

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Descriptors: \*Patents, \*Wastes water treatment, \*Industrial wastes, \*Water pollution treatment, \*Separation techniques, Water purification, Filtration, Incineration, Carbon, Activated carbon, Water reuse, Equipment.

Polluted waste water is combined with shredded Polluted waste water is combined with shredded trash including organic trash components to form a water-trash mixture from which inorganic sub-stances such as sand are initially gravitationally settled out and removed. The trash-water mixture is then passed into a roughing filter constructed of individual, replaceable filter elements stocked with non-activated carbon to remove floating and sus-pended particulate matter. Water is then flowed through a fine filter, also constructed of individual filter elements but stocked with activated carbon through a fine filter, also constructed of individual filter elements but stocked with activated carbon for the removal of remaining particulate matter as well as dissolved substances. The filter elements are intermittently regenerated by heating the coal and the residue deposited thereon under an oxygen deficiency to degas organic matters of the residue and form additional filter carbon, both non-activated and activated carbon. Trash may further by separately incinerated, also under an oxygen deficiency to generate heat for the degassing process and to generate additional combustible gas which is used to drive motors or turbines for generating electricity. Motor exhaust gas is used to predry the carbon in filter elements about to be regenerated by passing the gas through the elements. This also removes particulate contaminants from the exhaust by passing the gas through the elements. This also removes particulate contaminants from the exhaust gas. A preferred high temperature activated carbon filter backwashing method employing heat from the exhaust gas is also described. (Sinha-OEIS) W80-01182

SETTLING TANK STRUCTURE, Texaco Inc., NY. (Assignee). H. J. Thies.

U.S. Patent No 4,157,969, 6 p, 7 Fig, 2 Ref; Official Gazette of the United States Patent Office, Vol 983, No 2, p 364-365, June 12, 1979.

Descriptors: \*Patents, \*Oil pollution, \*Oil wastes, \*Waste water treatment, \*Oil-water interfaces, Baffles, Separation techniques, Equipment, Settling tanks, Gravity separation.

A settling tank structure for oil and water mixtures is described. It comprises an elongate tank having is described. It comprises an elongate tank having an inlet for the mixture on one end and a first outlet for water at the other end. The walls of the tank have a predetermined height for holding a predetermined quantity of the mixture for settling. The first outlet includes means for maintaining static liquid level in the tank at a predetermined height. The inlet is located near the top of the wall height, and the first outlet is located near the bottom of the wall. It also comprises a second outlet for oil located above the inlet near the top of the wall. Baffle means for maintaining piston-like displacement of the oil and water mixture are located from one end to the other. (Sinha-OEIS) W80-01183 W80-01183

METHOD AND APPARATUS FOR EXTRACT-ING WASTE MATERIAL, AB Kalle-Regulatorer (Sweden). (Assignee). G. I. Ingemarsson.

U.S. Patent No 4,158,627, 5 p, 1 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 983, No 3, p 594, June 19, 1979.

Descriptors: \*Patents, \*Waste water treatment, \*Sludge treatment, Sewage treatment, Drainage, Flocculation, Settling basins, Sludge dewatering.

A method for treating sludge as part of wastewater treatment comprises discrete and noncontinuing steps of: adding flocculating agents to a quantity of sludge and stirring the mixture; feeding the stirred mixture into a basin having a perforated bottom

#### WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Ultimate Disposal Of Wastes-Group 5E

and upon a first perforated web to allow water to drain; moving the web and hence the deposited residue to a location out of the basin to a pair of linear plates; and pressing the plates together to squeeze water from the residue between the plates. (Sinha-OEIS) W80-01185

PROCESS AND SYSTEM FOR CONTROLLING AN ORBITAL SYSTEM, Envirotech Corp., Menlo Park, CA. (Assignee). R. W. Okey. U.S. Patent No 4,159,243, 7 p. 8 Fig. 6 Ref; Official Gazette of the United States Patent Office, Vol 983, No 4, p 811, June 26, 1979.

Descriptors: \*Patents, \*Waste water treatment, \*Sewage treatment, \*Nitrification, \*Denitrification, Aeration, Oxygen, Control systems, Equipment, Orbital system.

The orbital system operates to accomplish nitrifica-tion and denitrification and includes a control system to control the extent to which nitrification and denitrification take place. However, the con-trol system is unable to operate effectively if the characteristics of the sewage fluctuate substantial-ly. An object of this invention is to provide a process and a system to control the operation of an orbital sewage freatment system the control procorbital sewage treatment system, the control process and system being capable of effective operation over a wide range of sewage characteristics. (Sinha-OEIS) W80-01188

METHOD AND APPARATUS FOR TREATING METAL CONTAINING WASTE WATER, Gotzelmann KG Industrieabwasser-Anlagen, Stuttgart (Germany, F. R.). R. Kammel, and H-W. Lieber. U.S. Patent No 4,159,235, 9 p, 2 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 983, No 4, p 808, June 26, 1979.

Descriptors: \*Patents, \*Waste water treatment, \*Water pollution treatment, \*Industrial wastes, \*Separation techniques, \*Metals, Electrolysis, Cathods, Anodes, Flow, Movement, Equipment, Product recovery.

A method for treating metal containing waste water employes a vessel containing the waste water in which there is provided at least one anode and a cathode consisting essentially of electrically conductive particles. The waste water is subjected to electrolysis during which the waste water and the particles of the cathode are being moved. The the particles of the cathode are being moved. The particles of the cathode are arranged in a cage closed on all sides whose walls are perforated. The cage is moved by an external force during the electrolysis in order to move the particles. The waste water is simultaneously moved by producing a forced flow through the particles. Movement of the electrodes can be realized by vibration, and the relative movement of the particles in conjunction with the forced flow of the waste water produces particularly favorable deposition conditions for metals. (Sinha-OEIS)

REMOVAL OF FLUORINE FROM WATER, Kohei Deguchi (Japan). (Assignee). M. Matsumoto.

M. Matsumoto. U.S. Patent No 4,159,246, 6 p, 4 Fig, 5 Tab, 7 Ref; Official Gazette of the United States Patent Office, Vol 983, No 4, p 812, June 26, 1979.

Descriptors: \*Patents, \*Waste water treatment, \*Water pollution treatment, Industrial wastes, Separation techniques, Fluorine, Chemical reactions, Electrolysis, Aluminium.

A method for removal of fluorine from water comprises putting aluminium sulfate or aluminium chloride and sodium aluminate into a treating water, and stirring the solution while adjusting the pH value in the range of 6.6 to 6.9, and removing the aluminium fluorides produced, thereby reduc-ing the fluorine content to 5 ppm or below. A further aspect of the invention comprises installing

an anode of aluminium against a cathode of copper or iron in a treating water, passing a d.c. current through it to ionize aluminium ions, adding aluminium sulfate or aluminium chloride and sodium aluminate to the treating water, and stirring the solution while adjusting the pH value in the range of 6.0 to 7.0 to produce aluminium fluoride hydrates to be adsorbed in flocks of aluminium hydroxides. (Sinha -OEIS) - OEIS) W80-01190

CATCH BASIN PROCESSING APPARATUS, LRS Research, Ltd., Broomall, PA. (Assignee). L.P. Taylor, and A. Petroski. U.S. Patent No 4,159,248, 13 p. 3 Fig. 14 Ref. Official Gazette of the United States Patent Office, Vol 983, No 4, p 813, June 26, 1979.

Descriptors: \*Patents, \*Waste water treatment, \*Sludge treatment, Settling basins, Dewatering, Landfills, Recycling.

A mobile system for cleaning and processing catch basin and/or lagoon waste products is described wherein the degree of waste product dilution is carefully controlled prior to transmission to a mobile dewatering truck. The truck comprises dewatering apparatus which is controlled to produce a substantially dry land fill suitable end product and water suitable for recirculation or environmentally acceptable discharge to a process head or sanitary sewer. (Sinha - OEIS)

## 5E. Ultimate Disposal Of Wastes

LABORATORY INVESTIGATION OF THE DY-NAMICS OF MUD FLOWS GENERATED BY OPEN-WATER PIPELINE DISPOSAL OPER-ATIONS,

ATIONS,
JBF Scientific Corp., Wilmington, MA.
G. Henry, R. W. Neal, and S. H. Greene.
Available from the National Technical Information
Service, Springfield, VA 22161 as AD-A062 488,
Price codes: A08 in paper copy, A01 in microfiche.
U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-46, August 1978. 155 p, 46 Fig, 5 Tab, 19 Ref, 3

Descriptors: \*Pipelines, \*Mud, \*Mudflows, \*Slurries, Laboratory tests, \*Dredged material, \*Dredged material disposal.

A laboratory study was made of the fluid mud system originating at the discharge point of open-water pipeline disposal operations. The objective was to define the dynamics of the mud system and to quantify the primary variables that control its behavior. These variables included salt content of ochavior. Inese variables included sair content of the sediment, slurry solids concentration, bottom slope, slurry flow rate, water current, and surface waves. The fluid mud system was characterized by head wave velocity, cloud height, fluid mud layer head wave velocity, cloud height, fluid mud layer thickness, concentration profiles, and bottom sediment deposition. Settling played an important role in the mud system dynamics. When settling was present, the head wave and mud flow slowed down and eventually stopped. In its absence, the mud system sustained its motion. Slurry flow rate and solids concentration influenced the mud system in accordance with the constant densimetric Froude number relationship. The fresh and saltwater systems did not revealevidence of flocculation. Bottom slope indicated the strongest control saltwater systems did not revealevidence of floccu-lation. Bottom slope indicated the strongest control over the dynamics of the mud system. A minimum downslope angle of 0.75 deg (slope 1:76) was re-quired for the flow to sustain itself. Water current generated more turbidity in the water column; these suspended solids were transported in the direction of the current. (WES)

PREDICTION OF VOLUMETRIC REQUIREMENTS FOR DREDGED MATERIAL CON-TAINMENT AREAS,
Oklahoma State Univ., Stillwater.

M. L. Hayden.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A062 481, Price codes: A19 in paper copy, A01 in microfiche. U.S. Army Engineer Waterways Experiment Sta-tion, Vicksburg, Mississippi, Technical Report D 78-41, August 1978. 432 p. 123 Fig, 13 Tab, 38 Ref,

Descriptors: \*Volume, \*Forecasting, \*Dredged material, \*Dredged material disposal, \*Volumetric

Results are presented of a study undertaken to determine the volumetric requirements of a confined disposal site filled with fine-grained dredged material. The method of study required a three-phase approach. The first phase was the evaluation of previous work and the formulation of a new prediction methodology based on modified consolidation theory and standard weight-volume relationships used in geotechnical engineering. The second phase consisted of developing the proposed prediction methodology. The final phase consisted of correlating the volume increase predicted by the proposed methodology with the rate of volume increase measured under field conditions. Also a computer program was created based on the prediction methodology developed during the study. computer program was created based on the prediction methodology developed during the study. The computer program was developed for the purpose of evaluating the effect of various input variables on the gain in available storage volume. Since the program was designed for applicability over a large range of conditions, the results obtained from the computer program are site-specific. The objective of this study was accomplished by evaluating the interrelationship of the various variables and their effect on the change in potential storage volume with time. (WES) W80-00912

EVALUATION OF THE SUBMERGED DISCHARGE OF DREDGED MATERIAL SLURRY DURING PIPELINE DREDGE OPERATIONS, JBF Scientific Corp., Wilmington, MA. R. W. Neal, G. Henry, and S. H. Greene. Available from the National Technical Information Service, Springfield, VA 22161 as AD-A062 612, Price codes: All in paper copy, A01 in microfiche. U.S. Army Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-44, August 1978. 232 p, 61 Fig. 8 Tab, 6 Ref. 2 Append.

Descriptors: \*Dredging, \*Pipelines, \*Turbidity, \*Dredged material, \*Dredged material disposal.

Investigates the feasibility of using submerged discharge to control turbidity generated when a pipe-line dredge discharges fine-grained dredged mate-rial slurry into open water. Program included a survey of field practices, literature survey, analytsurvey of field practices, literature survey, analytical investigations, and numerous flume tests. The investigation was performed at reduced scale in a specially constructed 8-ft-wide by 32-ft-long by 25-ft-leop etst tank. Two series of tests were run: one in which a simple open pipe discharged dredged material slurry underwater and a second in which four different types of discharge processors, designed to reduce the discharge momentum, ware tested and available the commercial their new tested to the contract tested and available the commercial their new tested to the contract tested and available the commercial tested to the contract tested teste sors, designed to reduce the discharge momentum, were tested and evaluated by comparing their performance with the open pipe. The influence of the following system parameters was examined: water type; sediment type; bottom type; solids concentration; and discharge velocity, angle, diameter or area, and height above the bottom. Results demonstrated that striking reductions in turbidity can be realized with a submerged discharge processor that diffuses the flow, minimizes entrainment, and discharges the dredged material slurry close to the bottom. The proposed design incorporates a conventional conical diffuser and a radial discharge section. Appendix A presents survey results of Corps of Engineers and private dredge operators who have been involved in open-water discharge. (WES) (WES) W80-00913

HABITAT DEVELOPMENT FIELD INVESTI-GATIONS, NOTT ISLAND UPLAND HABITAT DEVELOPMENT SITE, CONNECTICUT RIVER, CONNECTICUT; APPENDIX C: POST-

CATION

12 Ref; at Office, reatment,

reatment, n. Filtra-

shredded to form a tationally r mixture tructed of cked with and sus-en flowed individual ed carbon

elements g the coal an oxygen he residue on-activat-further by ygen defing process

gas which generating predry the egenerated This also he exhaust activated oying heat

Ref; Official Office, Vol

Oil wastes,

interfaces, ent, Settling

ter mixtures tank having and a first walls of the r holding a for settling. maintaining edetermined of the wall ed near the

ar the top of g piston-like mixture are Sinha-OEIS) EXTRACT-

gnee).

Ref; Official Office, Vol r treatment, it, Drainage, dewatering.

f wastewater oncontinuing a quantity of ng the stirred

rated bottom

# Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

## **Group 5E—Ultimate Disposal Of Wastes**

PROPAGATION MONITORING OF VEGETA-

TRUPAGATION MONITORING OF VEGETA-TION AND WILDLIFE, Connecticut Coll., New London. W. J. Barry, J. L. Tabachnick, R. S. Warren, A. C. Carroll, and W. A. Niering. Available from the National Technical Information Service Scriptfield V. 2016 19 April 2016

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A059 725, Price codes: A06 in paper copy, A01 in microfiche. U.S. Army Engineer Waterways Experiment Sta-tion, Vicksburg, Mississippi, Technical Report D-78-25, August 1978. 104 p, 19 Fig, 32 Tab, 26 Ref,

Descriptors: \*Wildlife habitats, \*Habitats, \*Monitoring, \*Connecticut River, \*Dredged material disposal, \*Disposal areas, \*Habitat development,

A 3.2-ha diked dredged material disposal site was constructed in 1975 on Nott Island in the Con-necticut River, 11 km upriver from Long Island Sound. It was filled with sandy dredged material, top-dressed with finer sediments, and experimentaltop-dressed with liner sediments, and experimentar-ly treated and planted with legumes and grasses. Monitoring of the planted vegetation and wildlife response to the vegetation during the 1977 grow-ing season is reported. (WES) W80-00914

DEVELOPMENT AND APPLICATION OF DESIGN AND OPERATION PROCEDURES FOR COAGULATION OF DREDGED MATERI-AL SLURRY AND CONTAINMENT AREA EF-

AL SLURRY AND CONTAINMENT AREA EF-FLUENT, Jones, Edmunds and Associates, Inc., Gainesville, FL. and Army Engineer Waterways Experiment Station, Vicksburg, MS. R. H. Jones, R. R. Williams, and T. K. Moore. Available from the National Technical Information Service, Springfield, VA 22161 as AD-A062 060, Price codes: A08 in paper copy, A01 in microfiche. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MI. Tech. Report D-78-54, Sept. 1978. 170 p, 19 Fig, 17 Tab, 13 Ref, 2 Append.

Descriptors: \*Coagulation, \*Slurries, \*Floccula-tion, \*Dredged material, \*Dredged material disposal. \*Containment areas

Guidelines are developed for the design of facilities to coagulate the overflow from a dredged material containment area. Pilot plant studies were conducted to study the efficiency of polyelectrolyte coagu-lation of overflow from a dredged material con-tainment area at an active freshwater dredging site. Full-scale studies were conducted at the same site on the feasibility of congulating dredged material by injecting polyelectrolytes into a hydraulic dredge pipeline. Results of the pilot plant studies showed that, under the conditions tested, polyelecstrolytes could be highly effective for coagulation of dredged material. Laboratory procedures were developed that can lead to the selection of the most effective coagulant, the optimum coagulant dosage, and the design parameters for a coagula-tion system. Examples are provided to illustrate procedures required to design a coagulation system for a containment area overflow. Results of fullscale tests on the injection of polyelectrolytes into scale tests on the injection of polyelectrolytes into a hydraulic dredge pipeline were highly variable. High mixing rates and variability of composition of dredged material and flow rates caused a wide variation in treatment efficiency. Design examples are provided for the design of polyelectrolyte feed systems to inject polymer into a hydraulic dredge pipeline. (WES) W80-00918

FIELD DEMONSTRATION OF SHRIMP MARICULTURE FEASIBILITY IN DREDGED MATERIAL CONTAINMENT AREAS, Dow Chemical U. S. A., Freeport, T.X. Texas Div. J. A. Quick, Jr., R. J. Hover, D. J. Milligan, W. F. McIlhenny, and S. E. Hill. Available from the National Technical Information Service, Springfield, VA 22161 as AD-A062 652, Price codes: A07 in paper copy, A01 in microfiche. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-53, August 1978. 139 p, 52 Fig. 4 Tab, 80 Ref. 1 append.

Descriptors: \*Shrimp, \*Dredged material,
\*Dredged material disposal, \*Waste disposal sites, material. Descriptors:

The potential of shrimp mariculture in dredged material containment areas (dmca's) as a productive use of those sites is examined. A 158-acre dmca located on the Gulf Intracoastal Waterway near Freeport, Texas was the demonstration site. A manageable 20-acre pond area was isolated from the main containment area by an internal levee and used as the culture pond. The pond was filled with 50-micron-screened seawater pumped from the Intracoastal Waterway. To kill any predators present in the water, the pond was treated with an icthyotoxin. Commercial agriculture fertilizer was added to the pond to stimulate a phytoplankton bloom which served as the sole food supply for the shrimp. No prepared food was provided to the shrimp No prepared food was provided to the shrimp with the pond was stocked with 30-day-old 'hardened' postlarval penaeid shrimp (Penaeus settlerus). Seven weeks later, average survival was estimated to be in the range of 86 to 93 percent and the average size of the shrimp sampled was 5.2 gm. (87 count, heads on). The harvest rate was estimated to average 185 to 200 pounds per acre. It is concluded that it is biologically and economically feasible to culture penaeid shrimp on a commercial scale in dmca's. (WES) dmca's. (W W80-00919

SUPPLYING WATER TABLE INTAKE THROUGH AGRICULTURAL USE OF URBAN

SEWAGE, Institute of Land Improvement in Green Lands, Wroclaw (Poland).

Wierzbicki. Available from the National Technical Information Service, Springfield, VA 22161 as AD-A046 304, Price code; A02 in paper copy, A01 in microfiche. U.S. Army Corps of Engineers, Draft Translation 652, 1977, 1 Fig. 2 Ref, Translated from Gaz woda i technika sanitarna, Vol 31, No 1, p 17-18. 1957.

Descriptors: \*Groundwater, \*Sewage disposal, \*Water table, \*Artificial recharge, \*Water supply, \*Groundwater recharge, Sewage, Land use, Waste water(Pollution), Waste water disposal, Irrigation, Land resources, Percolation, Urban hydrology, Drawdown, Water level fluctuations, Water levels, Sludge disposal,

Water table and surface water levels rose considerably and fallow land was transformed into lands and tailow land was transformed into lands with sewage water from urban areas, near Biele-feld, Poland, in 1951-1956. Bielefeld, a city of 170,000, uses groundwater as its major water supply; however in 1952, water table and area stream levels began to drop alarmingly with water supply demands of seven million cu m/yr. Forests and agricultural lands also began to show ground-water reduction effects. Urban sewage water now meets groundwater supplies quantitatively. Sewage percolation at low load conditions of 60-70 mm/ percolation at low load conditions of 00-70 mm/ month also guarantees good water quality. A tunnel and pipeline was built in 1953, conducting sewage by gravity to irrigate 620 ha fields. Con-duits were 23 km long and total costs were 8.6 million German marks. In 1954, five million cu m of initially treated sewage was pumped into neigh-boring streams; sewage was sprayed onto plowed fields. Fields soil was diluvial sand, 20-25 km deep; filtration rate averaged one m/d. After 1956, land irrigated with sewage water was transformed to arable lands and water levels in streams and waterworks supplies rose. Streams continued to carry pure water. (Danovich-Wisconsin) W80-00987

INTEGRATION OF THERMAL AND FOOD PROCESSING RESIDUALS INTO A SYSTEM FOR COMMERCIAL CULTURE OF FRESH-WATER SHRIMP (POWER PLANT WASTE HEAT UTILIZATION IN AQUACULTURE). HEAT UTI VOLUME 3,

The State Univ., NJ. Dept. of Physiol-Rutgers -

A. Farmanfarmian.

Available from the National Technical Information

Service, Springfield, VA 22161 as PB-275 870, Price codes: A07 in paper copy, A01 in microfiche. January 1977. 129 p, 20 Fig, 23 Tab, 87 Ref. AEN 7414079 A01 G1 43925.

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Descriptors: \*Heated water, \*Electric power plants, \*Aquiculture, \*Trout, \*Shrimp, Effluents, Foods, Food processing industry, New Jersey, Waster water(Pollution), Metabolism, Growth Fish. Water temperature, Heavy Toxicity, Coals.

Metabolism, short-term survival, growth, or conversion efficiency of shrimp and trout are not affected by actute or chronic exposure to power plant intake and discharge water; effluent with or without coal particles, or effluent with or without surry overflow mix. This study examines commercial cultures of freshwater shrimp, Macrobrachium rosenbergii, and rainbow trout, Salmo gairdneri, in thermal discharges of the Mercer power plant, Trenton, N.J. Shrimp tissues directly exposed to coal particles for three months reveal no accumulation in gills, muscle, and gastrointestinal tissues; however, stomach and intestines accumulate coal lation in gills, muscle, and gastrointestinal tissues; however, stomach and intestines accumulate coal particles. Chlorine, used as a biocide in oncethrough cooling water, has deleterious effects on all measured responses. Shrimp survive a 48 h exposure to 0.5 ppm total available chlorine, but 100% mortality occurs within seven h of a one ppm chlorine exposure. Trout survive four h exposure to 0.5 ppm total available chlorine; 100% mortality occurs in 10.5h. Both species are affected by raised mercury levels, which occur near coal burning power plants. Trout in Mercer ponds normally contain less than 0.002 ppm mercury in fresh muscle. At 0.5 ppm mercury exposures, mortality mally contain less than 0.002 ppm mercury in fresh muscle. At 0.5 ppm mercury exposures, mortality results over 10 d, fresh tissues accumulate 2.2 to nine ppm. Shrimp exposed to 0.25 ppm mercury experience 100% mortality in 6.1 d. Critical temperature maximum and minimum and lethal temperature maximum and minimum as well as dissolved oxygen and diet supplements are evaluated for growth and food conversion ratios. (Danovich-Wieroschie) Wisconsin) W80-01135

## 5F. Water Treatment and **Quality Alteration**

DEVICE FOR REGULATING DRINKING WATER.

Kabushikigaisha OMOCO, Saitama (Japan). (Assignee).

T. Okazaki U.S. Patent No 4,152,238, 15 p, 15 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 982, No 1, p 211, May 1, 1979.

Descriptors: \*Patents, \*Water treatment, \*Water softening, Water purification, Water quality control, Electrolysis, Electrodes, Temperature, Equip-

A device for softening and increasing the pH of drinking water comprises an electrolyzer vessel for receiving water; an unglazed partition member di-viding the vessel into a negative electrode chamber and a positive electrode chamber; and positive and negative electrodes. The electrodes are energized by direct current for a prescribed period of time to separate water in the electrolyzer into two components having a hydroxyl radical in different densi-ties by electrolysis and electroendosmose. The negative electrode has a hollow space for a heating element to warm the water body during the elecelement to warm the water body during the elec-trolysis to improving the softening of the water. A temperature sensitive means is electrically coupled to the heating element to control the temperature of the water and to avoid overheating of the negative electrode. (Sinha - OEIS) W80-00877

FILTRATION AND PURIFICATION APPARA-G. Rose

U.S. Patent No 4,152,262, 7 p, 10 Fig, 11 Ref; Official Gazette of the United States Patent Office, Vol 982, No 1, p 219, May 1, 1979.

Water Quality Control—Group 5G

B-275 870. Ref. AEN

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th, or conut are not e to power ent with or or without es commerrobrachium gairdneri, in ower plant, exposed to no accumu-tinal tissues; mulate coal le in once s effects on ive a 48 h hlorine, but h of a one four h expo-orine; 100% are affected ir near coal r ponds norcury in fresh es, mortality nulate 2.2 to pm mercury Critical temwell as disre evaluated

DRINKING (Japan). (As-

(Danovich-

Fig, 4 Ref; Patent Office,

nent, \*Water quality con-ature, Equip-

ng the pH of zer vessel for n member di rode chamber l positive and are energized iod of time to two compo-ifferent densiose. The neg-for a heating ring the elec-the water. A ically coupled e temperature eating of the

N APPARA-

Fig, 11 Ref; Patent Office. Descriptors: "Patents, "Water treatment, "Water purification, "Water quality control, Filtering, Mixing, Domestic water, Industrial water, Equipment, Iodine.

A filtration and purification apparatus is used in water lines of both domestic and industrial applications where water must be purified and filtered prior to use-particularly with respect to human consumption. A housing has an inlet port and an outlet port which can be connected directly into a outlet port which can be connected directly into a water system or connected to a water-system-outlet faucet and is thus a portable water filter/purifier unit. The inlet allows water to enter the filtering chamber by way of a check valve. The water passes through the filter member and then discharges into a metering compartment which is also provided with a check valve. The metering compartment is connected to both a mixing compartment and a purifying chamber, so that filtered water is directed from the metering compartment into both the purifying chamber and the mixing chamber. The purifying chamber includes a predetermined amount of iodine crystals. The controlled and mixed amount of water is discharged from the mixing chamber through the outlet of the housing for use. (Sinha - OEIS)

FILTER FOR TREATMENT OF NATURAL AND WASTE WATER, Leningrad Communal Agriculture Academy Re-search Inst. (USSR). For primary bibliographic entry see Field 5D. W80-00881

USE OF ACIDIFIED COPPER SULFATE IN HYDROGEN SULFIDE REMOVAL,

O. McLean. U.S. Patent No 4,153,547, 4 p, 1 Fig, 13 Ref; Official Gazette of the United States Patent Office, Vol 982, No 2, p 650, May 8, 1979.

Descriptors: \*Patents, \*Water treatment, \*Water purification, \*Wells, Odor, Sulfur, Filtration, Neu-tralization, Copper sulfate, Equipment, Filters, Backwashing.

A method of treating well water for purposes of desulfurizing the well water and making it palatable is described. The water is treated with an excess of acidified copper sulfate or other metal salt and delivered into the top of a treating tank which contains a neutralizing filter means. Copper sulfate is precipitated from the water and removed in the filter tank whereby sulfur-free neutral water is obtained. Any excess copper sulfate is precipitated as copper hydroxide and also removed in the filter. Periodically, the filter tank automatically backwashes itself to remove the copper residues or the filter may be manually backwashed if desired. (Sinha-OEIS) W80-00885

METHOD AND APPARATUS FOR CONDITIONING DEMINERALIZED WATER, UOP Inc., Des Plaines, IL. (Assignee).
A. B. Riedinger.
U.S. Patent No 4,153,556, 4 p, 2 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 982, No 2, p 653, May 8, 1979.

Descriptors: \*Patents, \*Wnter treatment, \*Water softening, Demineralization, Scaling, Hardness(Water), Carbon dioxide, Hydrogen ion concentration, Limestones, Equipment.

When brackish water or sea water is deminerawhen oracists water or sea water is deminera-lized, the feed stream generally requires pH adjust-ment. For storage and distribution the water must be conditioned or 'stabilized' by reducing the CO2 and additionally raising the pH to approximately 8. The concept of the invention is applicable to the product water from all demineralization devices where pH adjustment has been utilized to prevent calcium carbonate scaling. The purified water is fed through a wide-angle low pressure spray nozzle onto a conical surface where it films out at a relatively slow rate releasing the bulk of the free CO2. The stream then travels down a center tube

and up through a bed. The material in the bed is prefurably limestone chips. The bed diameter and height are so chosen that the water residence time neight are so chosen that the water residence time is at least two minutes, to insure reaction. This will convert the remaining CO2 to bicarbonate while dissolving an additional amount (a few ppm of calcium carbonate) and converting it to bicarbonate. Properly sized, the pH cannot go above 8 and there will be little if any free CO2. (Sinha-OEIS) W80-00887

#### KETTLE DISTILLING UNIT,

W. Andrei.
U.S. Patent No 4,156,631, 6 p, 7 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 982, No 5, p 1687-1688, May 29, 1979.

Descriptors: \*Patents, \*Water treatment, \*Water purification, Water pollution treatment, Distillation, Water quality control, Condensation, Domestic water, Equipment.

The invention provides a relatively inexpensive simple distillation unit which can be used with a source of boiling water such as a kettle which may be heated electrically or otherwise as desired. The kettle includes a spout through which steam is discharged and a source of circulating cooling water is provided. The unit comprises an enclosure with means to support the enclosure and also extends upwardly above the associated spout of the kettle. Seam entry means are provided at the base of the enclosure for receiving steam from the spout and the upper end of the enclosure is closed. A condensing coil is supported within the enclosure and the upper end of the enclosure is closed. A condensing coil is supported within the enclosure and means are provided to operatively connect the condensing coil to the source of circulating cooling water. Means are provided to collect condensate from the condensing coil at the base of the enclosure and to discharge it. A feed from the heated cooling water replenishes the water supply in the kettle and may be automatic if desired. (Sinha - OEIS) W80-00907 W80-00907

FLOTATION DEVICE WITH PRETREAT-

Office of the Secretary of the (Navy), Washington,

primary bibliographic entry see Field 5D. W80-00910

CHEMICAL, PHYSICAL, AND RADIOLOGI-CAL QUALITY OF SELECTED PUBLIC WATER SUPPLIES IN FLORIDA, NOVEMBER 1977-FEBRUARY 1978,

Geological Survey, Tallahassee, FL. Water Resources Div.

sources Div. G. A. Irwin, and R. W. Hull.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 829,
Price codes: A08 in paper copy, A01 in microfiche.
Geological Survey Water-Resources Investigations 79-50, 1979. 169 p, 6 Fig, 8 Tab, 12 Ref.

Descriptors: \*Florida, \*Potable water, \*Water quality, \*Water supply, \*Water treatment, Water quality standards, Water analysis, Chemical analysis, Surface waters, Groundwater, \*National Interim Primary and Proposed secondary drinking water regulations.

Virtually all treated public water supplies sampled in Florida meet the National Interim Primary and Proposed Secondary Drinking Water Regulations. These findings are based on a water-quality reconsissance of 129 treated public supplies throughout the State during the period November 1977 through February 1978. While primary drinking water regulation exceedences were infrequent, lead, selenium, and gross alpha radioactivity in a very few water supplies were above established maximum contaminant levels. Additionally, the secondary drinking water regulation parameters-dissolved solids, chloride, sulfate, iron, color, and pH-were occasionally detected in excess of the proposed Federal regulations. The secondary regulations, however, pertain mainly to the aesthetic quality of drinking water and not directly to public health aspects. (Woodard-USGS)

W80-00929

A STUDY OF THE IN-SITU INDIRECT FREEZ-

ING PROCESS, New Mexico Univ., Albuquerque. Dept. of Chemical and Nuclear Engineering. Dept. of Cl For primary bibliographic entry see Field 3A. W80-01006

A STUDY OF THE VACUUM-FREEZING HIGH PRESSURE ICE-MELTING PROCESS, New Mexico Univ., Albuquerque. Dept. of Chemical and Nuclear Engineering.
For primary bibliographic entry see Field 3A.
W80-01007

# 5G. Water Quality Control

THE RELATIONSHIP BETWEEN WATER DEPTH AND SEDIMENTARY PIGMENT CONCENTRATION IN TWO HOLOMICTIC BERK-SHIRE LAKES

Massachusetts Univ., Amherst. Dept. of Zoology. S. D. Ludlam.

S. D. Ludlam.

Available from the National Technical Information
Service, Springfield, VA 22161 as PB80-108590,
Price codes: A03 in paper copy, A01 in microfiche.
Water Resources Research Center, Univ. of Massachusetts/Amherst Publication No 105, 1979, 30
p, 6 Fig, 2 Tab, 27 Ref. OWRT A-109-MASS (1),
14-34-0001-8023.

Descriptors: \*Paleolimnology, \*Chlorophyll, \*Eutrophication, \*Sediments, \*Ponds, \*Lakes, Massachusetts, \*Berkshire lakes, \*Chlorophyll derivativations.

The concentration of chlorophyll derivatives and total carotenoids in the sediment of lakes studied to date is directly related to the depth of water overlying the sediment. This relationship is roughly linear until relatively deep water is reached where there is a tendency for sedimentary pigment concentration to increase more slowly or remain relatively stable with further increases in water depth. In each of two holomictic lakes, pigment profiles taken from all water depths below and including the littoriprofundal zone were similar in their major features, despite the influence of water depth on overall pigment concentration. The relationship between water depth and sedimentary pigment concentration is probably indirect. Although several explanations are possible it seems most probable that water depth controls turbulence and hence resuspension of the sediment of degradation and, therefore, the greatest concentration during resuspension. Thus, the least amount of degradation and, therefore, the greatest concentration of pigments are expected in deep water. If this explanation is correct, pigment profiles and pigment concentrations will reflect morphometry as well as fluctuating climate and water levels. For this reason caution is urged in interpreting pigment profiles, particularly in sediment deposited prior to historical records. (Godfrey-Mass) W80-00871

MATERIAL RECOVERY APPARATUS, Oil Mop Ltd., Christchurch (England). R. T. Challener.

U.S. Patent No. 4,146,477, 8 p, 4 Fig, 10 Ref; Official Gazette of the United States Patent Office, Vol 980, No 4, p 1414-1415, March 27, 1979.

Descriptors: \*Patents, \*Water pollution treatment, \*Water quality control, \*Oil pollution, Skimming, Adsorption, Equipment, Floating adsorbent rope.

A buoyant rope which has the property of preferentially adsorbing oil in relation to water is formed as a continuous loop which floats on the water between a desorption station where it is advanced through an oil desorption means and a rope-guide station remote from the desorption station where the run of the loop is guided around a guide pulley and through the desorption unit, the oil being removed from the incoming run of the rope to produce a continuously cleaned return run for a

#### Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

# Group 5G-Water Quality Control

further advance over the oil contaminated water. The rope guide structure is so constructed so that under the pull of the rope during relative movement between the desorption station and the liquid ment between the desorption station and the liquid the rope is brought into a disposition in which at least part of the length of it has a component of motion over the surface of the water. The rope guide structure includes steering means responsive to deviations in the tension of the rope from a predetermined tension so to steer the rope guide structure as to maintain or tend to maintain the tension of the rope at the predetermined tension. (Sinha-OEIS)

METHOD FOR THE DISTILLATION OF SEA

WATER,
Hitachi, Ltd., Tokyo (Japan).
For primary bibliographic entry see Field 3A.
W80-00875

BAR SCREEN.

M. Hori. U.S. Patent No 4,153,557, 3 p, 4 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 982, No 2, p 653, May 8, 1979.

Descriptors: \*Patents, \*Water pollution treatment, \*Water quality control, Screens, Running waters, Pollutants, Water pollution, Equipment.

An improved bar screen installed in flowing water to remove any rubbish is described. A bar screen is known which includes equally spaced parallel ring bars with scrapers arranged to scrape any rubbish from between the ring bars. Such a bar screen needs frequent cleaning to remove any rubbish caught between the scrapers and the ring bars and between the scrapers themselves. The object of this invention is to provide an improved bar screen which has scrapers that are easy to reset after cleaning. (Sinha-OEIS)
W80-00888

TWO-STAGE OIL-SEPARATOR,

Timmer (Henry), Grand Rapids, MI. (Assignee). H. Timmer, and L. V. Slikkers. U.S. Patent No 4;154,683, 9 p, 8 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 982, No 3, p 1029-1030, May 15, 1979.

Descriptors: \*Patents, \*Oil pollution, \*Water pollution treatment, Water quality control, Separation techniques, Equipment, Endless belts, Oil recov-

A machine for separating an oil film from a sup-porting liquid elevates the oil from its original position with an endless belt, and then transfers the oil from the belt to a rotating disc from which it is wiped into a drainage trough. The belt system is driven from the disc, and is constructed as an attachment to a self-contained disc machine capable of functioning without the belt system when the disc can intersect the surface of the liquid. The unit is thus adaptable to installations where the liquid level is far below the rim of the accumulating tank where the machine is mounted, and where there is substantial variation in the liquid level. (Sinha-OEIS) W80-00897

APPARATUS TO FACILITATE BURNING OF A LAYER OF OIL, PARTICULARLY OIL SPILLS,

U.S. Patent No 4,154,684, 5 p, 6 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 982, No 3, p 1030, May 15, 1979.

R. D. Tokarz

Descriptors: \*Patents, \*Oil spills, \*Oil pollution, \*Water pollution treatment, Water quality control, Burning, Heat transfer, Equipment, Thermal insu-

An apparatus for facilitating the burning of an oil spill in situ is described which utilizes closely associated floating facilitators. The facilitators are constructed of a highly insulative and porous mate-

rial for subdividing the oil spill into separably definable oil columns that are substantially thermally insulated from the body of water to minimize heat transfer between the body of water and the oil spill. (Sinha-OEIS) W80-00898

KETTLE DISTILLING UNIT. For primary bibliographic entry see Field 5F. W80-00907

DUAL-PURPOSE DETENTION BASINS, Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst. W. Whipple Jr. Journal of the Water Resources Planning and Man-agement Division, American Society of Civil Engi-neers, Vol 105, No WR2, Proceedings Paper 14860, p 403-412, September 1979. 3 Fig, 32 Ref, 1 Append.

Descriptors: \*Flood control, \*Water quality control, \*Basins, \*Urbanization, Urban runoff, Water pollution, Water quality, Sediments, Sediment control, Multiple-purpose projects, Multiple-purpose reservoirs, Runoff, Urban runoff, Dams, Reservoirs, Design, Hydrology, Detention basins, Dual-

Design criteria for small detention basins, which are being built in large numbers to reduce flooding in rapidly urbanizing areas, may be modified to serve additionally the purpose of reducing runoff pollution, which also accompanies urbanization. Only slight reduction in local flood-control effectiveness will be entailed by the modification, and Only slight reduction in local flood-control effectiveness will be entailed by the modification, and the dual-purpose basins will be more useful in aid of flood control further downstream than the single purpose locally oriented structures. Runoff pollution from urbanizing areas is important to water quality planning and occurs largely in particulate form. However, the trap effectiveness of detention basins for different kinds of pollutants, retained in storage for various periods, has not yet been determined by research or practical experience; so that design criteria for dual-purpose detention basins cannot be stated with any degree of precision. (Sims-ISWS) precision. (Sims-ISWS) W80-00975

STATISTICAL EVALUATION OF SAMPLING FREQUENCIES IN MONITORING NET-FREQUENCIES WORKS,

Colorado State Univ., Fort Collins. For primary bibliographic entry see Field 7A. W80-00976

ANALYSIS OF WATER RESOURCES RE-QUIREMENT FOR THE ENHANCED (TERTI-ARY) OIL RECOVERY IN THE SOUTHERN PLAINS REGION OF THE UNITED STATES, Texas Univ. at San Antonio. Div. of Environmental Studies

Chia Shun Shih, and H. Hamilton. Chia shun Smin, and H. Hamilton.
Available from the National Technical Information
Service, Springfield, VA 22161 as PB80-110869,
Price codes: Al 0 in paper copy, A01 in microfiche.
Technical Completion Report, September 1979,
207 p., 28 Fig., 33 Ref. OWRT B-218-TEX (1). 1434-00018120.

Descriptors: \*Water requirements, \*Available water, \*Water quality, \*Oil industry, \*Oil recovery, Southern Plains Region(US), Texas, Oklahoma, New Mexico, Louisiana

This report analyzes the water esources requirements, in terms of both water quantity and quality, for the anticipated enhanced oil recovery operations to be implemented in the Southern Plains region of the United States. The enhanced oil recovery potential of each oil-producting reservoir in the four states of Texas, Oklahoma, New Mexico, and Louisiana is assessed using parameters describing the basic characteristics of crude oil and the reservoir formation. The water resources, in-cluding the surface water and groundwater re-sources will be delineated by producing subre-gions. An analysis has been performed to deter-

mine the incremental water demand and water quality requirements for enhanced oil recovery operations based on overall domestic, agricultural, and industrial demands versus water resources available. Potential enhanced oil recovery productions associated with alternative pricing scenarios are used in the assessment of water resources con-straining effects. The water quality impacts of enstraming enects. The water quanty impacts of en-hanced recovery methods are assessed considering surface water pollution by discharged chemicals and waste waters, groundwater pollution by the fracture of well casings, and infiltration of chemi-cals and oil/water mixtures. W80-01005

IMPACT OF THE ARGO MERCHANT OIL SPILL ON MACROBENTHIC AND PELAGIC ORGANISMS,
Food and Agriculture Organization of the United States, Rome (Italy).
For primary bibliographic entry see Field 5C.
W80-01145

OIL SPILL BEHAVIOR IN ICE DURING THE 1977 BUZZARDS BAY OIL SPILL, For primary bibliographic entry see Field 5C.

WEATHERING ESTIMATIONS FOR SPILLED OIL FROM BOUCHARD NO 65, NOAA National Analytical Facility, Seattle, WA. For primary bibliographic entry see Field 5C.

PHYSICAL ASPECTS OF THE OIL SPILL FROM THE SUPERTANKER 'METULA', Texas A and M Univ., College Station. For primary bibliographic entry see Field 5C. W80-01150

THE IMPACT OF THE SANSINENA EXPLOSION AND BUNKER C SPILL ON THE MARINE ENVIRONMENT, University of Southern California, Los Angeles. Inst. for Marine and Coastal Studies. For primary bibliographic entry see Field 5C. W80-01152

THE FATE AND WEATHERING OF SURFACE OIL FROM THE BRAVO BLOWOUT, Continental Shelf Inst., Trondheim (Norway). For primary bibliographic entry see Field 5C. W30-01153

PROFILING WATER QUALITY SENSING

SYSTEM, General Dynamics, San Diego, CA. Electronics

Div. J. H. Hinchman. U.S. Patent No 4,157,657, 14 p, 13 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 983, No 2, p 262, June 12, 1979.

Descriptors: \*Patents, \*Water quality control, \*Testing, Water analysis, On-site tests, Profiles, Instruments, Equipment, Electronic equipment, Sensing, Sensors

A system for obtaining a vertical profile of water quality in a body of water is disclosed. The system includes a sensor for sensing predetermined characteristics of water and the depth of water at which the predetermined characteristics are sensed, a cable attached to the sensor for holding senset, a capie attached to the sensor for holding the sensor, and a winch assembly attached to the cable for deploying and retrieving the cable and the sensor. The winch assembly includes a non-ventilated DC motor coupled to the drum for driving the drum to retrieve the cable, and for generating electricity during deployment of the cable in response to the torque on the motor cre-ated by the cable and the sensor during deployared by the capie and the sensor during deploy-ment, an electromagnetically released brake coup-led to the motor for braking the motor when the brake is not energized, a battery for providing energy for the motor and the brake, and a motor

# Techniques Of Planning-Group 6A

controller coupled to the battery for providing constant voltage excitation of the motor and for controlling the brake. The motor controller in-cludes a circuit which inhibits the motor from operating as a motor during deployment of the cable, and a circuit for reversing the polarity of the cable, and a circuit for reversing the polarity of the motor to cause the motor to generate electricity for recharging the battery during deployment of the cable. A control circuit is coupled to the sensor and to the motor controller for causing the motor controller to brake and stop the motor in response to sensing a predetermined depth of water. (Sinha-OEIS) W80-01179

> SENSOR DEVICE FOR WATER SOFTENER SYSTEM

J. Fleckensteim A. J. Fleckensteim.
U.S. Patent No 4,158,628, 5 p, 3 Fig, 4 Ref; Official
Gazette of the United States Patent Office, Vol
983, No 3, p 595, June 19, 1979.

Descriptors: \*Patents, \*Water treatment, \*Water quality control, \*Water softening, Ion exchange, Calcium, Sodium, Electric currents, Regeneration,

This invention provides a sensor device that is direct acting in response to the calcium/sodium state of the ion exchange material in which it is fully immersed and having full flowing contact with the water in the treatment tank so that it is fully responsive to such state immediately, as changes occur. The sensor is tubular and the sensor element comprises a tube of ion exchange material which reacts to the state of the ion exchange which reacts to the state of the ion exchange material in the treatment tank by expanding and contracting according to the calcium or sodium state of the tube. The device incorporates electrical contacts and when the tube is expanded the contacts are open and when the tube is contracted the contacts are closed to complete an electrical circuit. When the ion exchange material in the tank has been regenerated it is in the sodium state and the material of the tube as well, so that it is expanded and the contacts are open to open the electrical circuit. When the ion exchange material in the tank is depleted both the material of the tank and that of the tube are in the calcium state so that in the tunk is depleted both the material of the tank and that of the tube are in the calcium state so that the contracts in the sensor are closed to complete the electrical circuit. (Sinha-OEIS) W80-01186

## 6. WATER RESOURCES **PLANNING**

#### 6A. Techniques Of Planning

SOLUTION OF LARGE SCALE PIPE NET-WORKS BY IMPROVED MATHEMATICAL

APPROACHES, Southern Methodist Univ., Dallas, TX. School of Engineering and Applied Science.
M. A. Collins, L. Cooper, R. V. Helgason, and J.

M. A. Collins, L. Cooper, R. V. Helgason, and J. L. Kennington.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-106651, Price codes: A08 in paper copy, A01 in microfice. Technical Completion Report IEOR 77016-WR77001, August 1978, 155 p, 14 Fig, 19 Tab, 108 Ref, 3 Append. OWRT C-7115 (No 6223) (2), 14-34-0001-6223.

Descriptors: \*Networks, \*Pipe networks, \*Water distribution(Applied), Open channel networks, Mathematical programming, Nonlinear networks, Nonlinear programming, Operations research, NETFLO, WATSIM, Hardy cross, Newton-Raphson, Linearization, PARTAN, Convex simplex, Piece-wise, linear, approximation. plex, Piece-wise linear approximation, Content model, CoContent model, Frank-Wolfe algorithm.

The classical pipe network analysis problem is traditionally solved using iterative methods-Hardy Cross, Newton-Raphson, or linearization. Kuhn-Tucker theory is used to show that there exists two mathematical programming models whose solution is precisely the solution to the pipe network analysis problem. Three optimization algorithms—Frank-

Wolfe, convex simplex, and piece-wise linear approximation-are used to solve four pipe network analysis problems using one of the mathematical programming models. Computational behavior is compared to that of a state of the art Newton-Raphson code. Computational experience with a network of 452 nodes and 530 elements is detailed. Numerical experiments clearly demonstrate that solution of the pipe network analysis problem using mathematical programming techniques is an attractive alternative to currently used iteration methods. Preliminary extension of the models is made to open channel networks. The models are also used to demonstrate the existence of, or lack of, solution uniqueness.

W80-00869

BASELINE WATER QUALITY OF IOWA'S COAL REGION,

Geological Survey, Iowa City, IA. Water Resources Div.

Geological Survey open-file report 79-980, 1979. 74 p, 1 Fig, 7 Tab, 7 Ref.

Descriptors: \*Baseline studies, \*Water quality, \*Streams, \*Iowa, \*Streamflow, Flow rates, Water analysis, Sampling, Chemical analysis, \*Pre-coal mining, \*South-Central Iowa, White Breast basin, mining, \*South-Central Ic English basin, Cedar basin

To assist the Iowa Department of Environmental Quality in determining the effects that coal mining and attendant activities will have on the water quality of Iowa streams, the U.S. Geological Survey collected three sets of water-quality samples (representative of high, average, and Iow streamflow) in the White Breast, English,aand Cedar Creek basins in south-central Iowa. These samples were analyzed by the U.S. Geological Survey Central Laboratory at Denver, Colorado, and by the Iowa State Hygienic Laboratory (Iowa City and Des Moines). The report presents the data collected from May to November 1978 at 15 stations in the study area. (Woodard-USGS) W80-00931

A DIGITAL MODEL FOR SIMULATION OF A DIGITAL MODEL FOR SIMULATION OF GROUND-WATER HYDROLOGY IN THE HOUSTON AREA, TEXAS, Geological Survey, Houston, TX. Water Re-sources Div. W. R. Meyer, and J. E. Carr. Texas Department of Water Resources LP-103, August 1979. 133 p, 15 Fig, 36 Ref, 3 Append.

Descriptors: \*Model studies, \*Hydrogeology, \*Computer models, \*Aquifer characteristics, \*Groundwater movement, Simulation analysis, Clays, Withdrawal, Transmissivity, Hydraulic conductivity, Leakage, Water storage, Water levels, Water table, Texas, \*Houston area, \*Chicot aquifer(TX), \*Evangeline aquifer(TX), Finite-difference model.

This report documents the construction and calibration of a digital model for the simulation of hydrologic conditions in the Chicot and Evange-line aquifers in the Houston area of southeastern Texas. The model is a five-layer finite-difference model, with a grid pattern of 63 x 67 nodes representing an area of 27,000 square miles, for simulation of three-dimensional ground-water flow. The hydrologic properties and processes modeled were ground-water withdrawals, transmissivities, storage coefficients of the aquifers and clays, quantity of water derived from storage in the clays, and vertical hydraulic conductivity and vertical leak-age. The model, which simulates water-level deage. The model, which simulates water-level de-clines, changes in storage in the clay layers, and land-surface subsidence, was calibrated by use of historical records from 1890 to 1975. It is very sensitive to variations in transmissivities and to variations in water-table and artesian storage. It is less sensitive to variations in clay storage. (Woodard-USGS) W80-00935

ASSESSMENT OF FITTING TECHNIQUES FOR THE LOG PEARSON TYPE 3 DISTRIBUTION USING MONTE CARLO SIMULATION,

Queen's Univ., Kingston (Ontario). For primary bibliographic entry see Field 2E.

A CONCEPTUAL DETERMINISTIC ANALYSIS OF THE KRIGING TECHNIQUE IN HYDROL-OGY.

IBM Scientific Center, Venice (Italy). G. Gambolati, and G. Volpi. Water Resources Research, Vol 15, No 3, p 625-629, June 1979. 1 Fig. 8 Ref.

Descriptors: \*Data processing, \*Forecasting, \*Methodology, \*Analytical techniques, Hydrologic data, Numerical analysis, Mathematics, Model studies, Analysis, \*Kriging technique, \*Interpolation methods, Predictive ability, Interpolation error Main trend

A stochastic approach to interpolating sparse ob-A stochastic approach to interpolating sparse ob-servationrecords in hydrology, referred to as the 'kriging technique', has recently been developed. Distinct primary features of this method are sup-posed to be its predictive reliability and its ability to provide an estimation error. A deterministic analysis for the kriging technique indicated its close relationship with the most traditional interpolation schemes. The formulation showed that any claim to more accurate estimates than with other commonly used methods cannot be substantiated commonly used methods cannot be substantiated. However, a unique and distinct advantage of the kriging technique is its ability to provide an assessment of the interpolation error. An attempt also was made to give a deterministic interpretation for the main trend. The conclusions of the analyses made suggested that in practical applications, the interpolation model is not improved by the use of a main transfer where its experience of a second and the substantial of trend, unless its expression reflects some additional information related to the general hydrologic context but not included in the available observations. (Singh-ISWS) W80-01028

MAR DEL PLATA ACTION PLAN,

In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol 1, Part 1, p 273-332.

Descriptors: \*United Nations Water Conference, \*Water management(Applied), \*Water resources development, \*International cooperation, \*Water development, International cooperation, Water policy, Legislation, Adoption of practices. Regula-tion, Water distribution(Applied), Water demand, Forecasting, Municipal water, Waste disposal, Ag-riculture, Irrigation, Industrial water, Hydroelec-tric power, Inland waterways, Navigation, Public health, Water pollution control, Institutional con-straints, Flood control, Droughts, Training, Research priorities.

Twenty-six general recommendations for action by the UN as a whole, by its regional agencies, and by member states, are agreed upon by the 1977 United Nations Water Conference. Recommendations cover: assessment of water resources, legislation for improved water use and efficiency, improved for improved water use and efficiency, improved regulation and distribution of water resources measurement and projections of water demand, community water supply and waste disposal, agricultural water use, fisheries, industrial water use, hydroelectric power generation, inland navigation, water-related environment and health considerations, pollution control, national water policies, institutional arrangements, legislation, public participation, development of appropriate technologies, flood loss management drought loss management, education and training for water resources ment, education and training for water resources management, research needs, development of management, research necess, development of shared water resources, international cooperation, financing arrangements for water development, technical cooperation among developing countries. In addition to the general recommendations, re-gional recommendations are made for Africa, Europe, Latin America and Western Asia. (Harris-Wisconsii) W80-01109

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SENSING

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## Field 6—WATER RESOURCES PLANNING

# Group 6B-Evaluation Process

#### 6B. Evaluation Process

URBANIZATION AND WATER QUALITY PLANNING: THE 208 EXPERIENCE IN MAS-PLANNING: ALL SACHUSETTS, Clark Univ., Worcester, MA. Dept. of Environ-

mental Affairs

E. Schwarz, B. B. Johnson, R. J. Caiazzo, and D. F. Pincus

Available from the National Technical Information Avanaoie from the National Technical Information Service, Springfield, VA 22161 as PB80-106743, Pric codes: A07 in paper copy, A01 in microfiche. Water Resources Research Center, Univ. of Mas-sachusetts/Amherst Publication No 104, 1979, 135 p, 55 Tab, 9 Ref, 10 Append. OWRT-A-104-MASS (1), 14-34-0001-8023.

Descriptors: \*Comprehensive planning, \*Urbaniza-tion, \*Water Resources Planning Act, Massachu-setts, Water resources planning, Urban planning,

The initial premise of this study was that the degree of urbanization in an area would affect the oegree of uroanization in an area would affect the scope of the planning process, public participation in planning, and the plan itself. Three measures of urbanization were used in this study: the percent-age of the region in urban land use; the proportion of the population served by sewers; and the popu-lation density. Each of these was an independent variable in assessing the inter-regional variation of attributes of the 208 plans and of the 208 planning process. It was found that the degree of urbanization does not appear to have been a significant factor in the 208 planning process. Other findings about the 208 planning process were that each region had its own procedure of gathering and presenting data and recommendations, that plan contents were not consistent among regions, that regional funding did not seem to have been corre-lated with population size, land area, number of political entities, or water quality, and that plans did not recommend new management agencies nor make many specific or mandatory recommendamake many specific or mandatory recommenda-tions. In short, the 208 planning process in Massa-chusetts and the resulting plans were highly idio-syncratic, and tended to reflect town priorities rather than national pollution abatement goals. Doubts must be raised about its substantive accomplishments when measured against the objectives of the Clean Water Act. W80-00870

MODELING RECREATION USE IN WATER-

MODELING RECREATION USE IN WATER-RELATED PARKS, Regional Science Research Inst., Philadelphia, PA. R. E. Coughlin, D. Berry, and P. Cohen. Available from the National Technical Information Service, Springfield, VA 22161 as AD-A071 898, Price codes: A05 in paper copy, A01 in microfiche. U.S. Army Engineer Waterways Experiment Sta-tion, Vicksburg, Mississippi, Technical Report R-78-1, October 1978. 94 p, 6 Fig, 12 Tab, 26 Ref, 3 Append.

Descriptors: \*Parks, \*Recreation, \*Model studies.

This report extends to nonreservoir parks the earlier work of the U. S. Army Corps of Engineers on the recreation use of reservoir parks. A thorough review of the literature was followed by a test of several models including those already completed by the U. S. Army Engineer District, Sacramento. For this test, data from New York State Parks were used. The results are somewhat weaker than those obtained by the Sacramento District. This is anose organica by the Sacramento District. This is attributed, in part, to the fact that the data were collected for another purpose and did not contain as many observations as would be desirable for a spatial analysis of this type. (WES) W80-00915

DEVELOPMENT OF IMPROVED DECISION-ORIENTED RECREATION USER INFORMA-TION SYSTEM,

Midwest Research Inst., Kansas City, MO.
R. M. Mischon, and R. C. Wyatt.
Available from the National Technical Information
Service, Springfield, VA 22161 as AD-A062795,
Price codes: A06 in paper copy, A01 in microfiche.

U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report R-78-2, October 1978. 115 p, 8 Tab, 22 Ref, 2

Descriptors: \*Recreation, \*Recreation facilities, \*Data collections, \*Information systems.

This report examines ways to improve the visitation input data to the Recreation Resource Management System (RRMS) and evaluates the need for an overall recreation information system. An important information need Corps-wide is to foreimportant information need Corps-wide is to fore-cast the impact of national and regional trends in recreation participation growth, sale of various types of recreation equipment and other factors that affect park area use. The development of a supplemental recreation information system that could be used with existing systems was proposed. A supplemental system would provide planners and managers with better tools to handle basic functions such as project feasibility, site planning, management, etc. Five major tasks are identified regarding improvement of visitation data and de-velopment of an overall information system: (a) regarding improvement of visitation data and development of an overall information system: (a) Research and analysis; (b) Collection and storage of data; (c) Computer requirements; (d) Training and quality control; (e) Reporting. These functions are described and the advantages and disadvantages associated with four administrative decision scenarios are examined. The conclusion is that the Waterways Experiment Station should expand its waterways Experiment Station should expand its role to include improvement of the visitation data, and undertake development of a supplemental information system. A final part of the report identifies and discusses major administrative aspects associated with this conclusion. (WES) W80-00920

GENERATION AND EVALUATION OF ALTERNATIVE PLANS FOR REGIONAL WASTEWATER SYSTEMS: AN IMPUTED

WASLEWAIER SYSTEMS: AN IMPUTED VALUE METHOD, Louisville Univ., KY. Dept. of Chemical and Envi-ronmental Engineering. For primary bibliographic entry see Field 5D. W80-00982

A METHODOLOGY FOR THE SELECTION OF AQUATIC NATURAL AREAS,
Idaho Univ., Moscow, ID. Dept. of Biological

Sciences. F. W. Rabe, and N. L. Savage. Biological Conservation, Vol 15, No 4, p 291-300, June, 1979. 1 Fig. 2 Tab, 10 Ref. OWRT A-046-June, 19 IDA (2).

Descriptors: \*Aquatic environment, \*Preservation, \*Methodology, \*Land management, Physical properties, Biological communities, Wetlands, properties, Habitat.

A methodology is presented for selection of aquatic natural areas based on numerical ranking of sites. Non-weighted points are assigned to 24 physical and biological characteristics of the aquatic and terrestrial components of a proposed natural area. Cumulative score reflects both natural diversity and occurrence of unusual species or conditions. A and occurrence of unusual species or contitions. A systematic selection procedure is described which can be utilized by land managers and natural area organizations to arrive at and support objective decisions involving natural area selection. (Howard-Mass)
W80-00986

ECONOMIC IMPACT OF THE SELENIUM EF-FLUENT STANDARD IN ILLINOIS (R76-21), Northern Illinois Univ., De Kalb. Dept. of Geolo-

gy. R. C. Flemal, R. W. Crown, B. E. Morgan, and D. Wilkin.

C. Wilkin.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 173, Price codes: A05 in paper copy, A01 in microfiche. Illinois Institute for Environmental Quality, Doc No 77/34, October 1977. 88 p, 32 Tab, 94 Ref, 2 Append. Append.

Descriptors: \*Illinois, \*Selenium, \*Water quality standards, \*Economic impact, \*Effluents, \*Regula-

tion, \*Water pollution control, Water pollution, Water quality, Economics, Cost-benefits analysis, Technology, Water policy, Toxicity, Chemicals, Pollutant

The principal economic impact of a proposed Illinois amendment deleting the selenium (Se) effluent standard from water quality regulations is the \$20 savings per sample charged to dischargers for water analysis. This study evaluates natural Se occurrences; levels, trends, sources in surface waters and effluent discharges; environmental impact, and costs and benefits of regulation versus deregulation. In Illinois detectable Se background concentrations are found only in a few streams. The metalloid is used widely in industrial processes concentrations are found only in a few streams. The metalloid is used widely in industrial processes however, only petroleum refining industries have significant seleniferous effluent records. Se is an essential nutrient for many plants and animals; it is also toxic in large amounts (0.05-2.0 mg/l) to plants, animals and humans. Present Illinois standards limit Se concentrations to one mg/l, except ards inmit se concentrations to one mg/, except where water is used for public water supply with 0.01 mg/l standards. On 24 June 1975, the Mara-tion Oil Company at Robinson had a 3.08 mg Se/l discharge, the only discharge above the normal standards. Numerous discharges occur above the 0.01 mg Se/l standards, however, not all of these discharges occur in public water supply streams. Although Marathon's effluent affects water quality Atthough Maratnon's effluent affects water quanty at outfall and downstream locations by completely eliminating animal life, nothing can be said about specific Se impacts in the effluent. The proposed amendment deleting Se effluent standards, will therefore, have no impact on the people of Illinois. (Danovich-Wisconsin) W80-00989

ECONOMIC IMPACT OF IRRIGATED AGRI-

CULTURE IN WEST MINNESOTA, Minnesota Univ., Minneapolis. Dept. of Agricul-ture and Applied Economics. W. R. Maki, L. A. Laulainen, M. Chen, and D. R.

Minnesota University, Miscellaneous Report 151-1978, 24 Tab

Descriptors: \*Economics, \*Irrigation, \*Benefits, \*Agriculture, \*Regional development, Minnesota, Employment, Economic impact, Investment, Direct benefits, Population, Land development, Irrigated land, Production, Numerical analysis, Income, Industries, Model studies, Demand.

Total direct, indirect, and induced economic impact of irrigated agriculture development in West Minnesota is projected at \$106,132,000 (1970 dollars) for 1985, equivalent to 10,93 gross regional product in 1970. The 1985 total irrigation economic impact equals \$400 per person benefits (1970 dollars) for the 265,000 people projected for West Minnesota. This benefit occurs largely because of additional jobs supported by expanded agriculture-related activity and expanded household expenditures. Four statistics summarize irrigation developadditional jobs supported by expanded agriculture-related activity and expanded household expendi-tures. Four statistics summarize irrigation develop-ment economic impacts: gross regional product (GRP), employment, gross output, and investment multipliers. For the 1970-85 period, the multipliers are: 5.7 for investment, 2.7 for employment, 2.2 for GRP, and 1.6 for gross output. GRP is the most informative multiplier for development planning purposes, showing total value added to gross re-gional and national product by \$1 of value added from agricultural development. Direct impacts on 1985 gross regional product is projected at \$47.8 million. Total 1985 employment under agricultural development is projected at 98,906, an increase of 5,399 jobs over baseline figures. The development increment in agricultural output is estimated at \$146,535,000. An additional \$3,100 of gross regional aproduct is created by an added \$1,000 invest-ment costs, for the total economy, \$5,704 of gross regional product is created for the same invest-ment. (Danovich-Wisconsin)

LAKE KINNERET FISHING AND ITS DEVEL-

OPMENT, Hebrew Univ., Jerusalem (Israel). Dept. of Zoology. K. Reich.

**Evaluation Process—Group 6B** 

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proposed Illi-n (Se) effluent ons is the \$20 schargers for es natural Se es in surface ulation versus e background few streams. trial processes dustries have l animals: it is 2.0 mg/l) Illinois standmg/l, except r supply with 75, the Mara-3.08 mg Se/l te the normal cur above the ot all of these pply streams. water quality by completely be said about The proposed

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ITS DEVEL Dept. of ZooBamidgeh, Vol 32, No 2, p 37-64, June 1978. 10 Fig, 5 Tab, 23 Ref.

Descriptors: \*Commercial fishing, \*Lake Kinneret(Israel), \*Resources development, \*Fish harvest, Fishing, Nets, Fishing gear, Fish, Bleak, Tilapia, Barbel, Carp, Mullet, Fish management, Fish stocking, Israel, Fisheries, Economics, Aquatics environment, Marketing.

Commercial fishing in Lake Kinneret, Israel, between 1935 and 1976 is reviewed. During this period, mean yearly catch has increased 6.5-fold from 265 tons in 1935-40 to 1,748 tons in 1969-73. period, mean yearly catch has increased 6.5-fold from 265 tons in 1935-40 to 1,748 tons in 1969-73. At the same time, yearly catch per fisherman has increased from 1.5-2.0 tons to approximately 9.7 tons. Changes in environmental conditions, fishing regulations which protect young fish, increased marketing possibilities, stocking of new species, and especially technological development of fishing methods are responsible for this growth. Yield according to main fish groups is outlined. The haul of bleak has grown almost 10-fold during the 40 years to a current level of 1,046 tons per year, and is expected to level off at an annual mean of 1,250-1,300 tons. Two stages of growth are noted, the first due to the development of illuminated fishing and greater marketing possibilities, and the second due to environmental changes which increased the bleaks natural breeding rate. Barbel yield decreased from 90 tons per year during 1935-47 to 40 tons in 1949-54, but has increased to a constant 130 nos with the introduction of nylon and monofil fiber nets. The Tilapia catch has increased from an annual mean of 55 tons to 325 tons. The Carp yield despite its high market price has remained low since its introduction in the early 1940's. Mullet stocking has produced very favorable results with 122 tons of fish retrieved for each million fingerlings planted. Exploitation of silver carp, the fish best suited to the lakes biological condition, presents technical and economic problems. It is concluded that the lakes fishing potential has not yet peaked. (Luedtke-Wisconsin)

OPTIMAL HARVESTING POLICIES AND REGULATIONS FOR RENEWABLE RE-

Pittsburgh Univ., PA. Dept. of Economics. T. Takayama, and M. Simaan. University of Illinois (Urbana-Champaign) Faculty Working Papers No 466, February 10, 1978. 16 p, 7

Descriptors: \*Optimization, \*Mathematical models, \*Harvesting, \*Resource development, \*Resources, \*Regulation, \*Natural resources, Equations, Economics, Dynamic programming, Fishing, Commercial fishing, Fisheries, Water policy, Fish harvest, Population, Conservation, Management, Exploitation, Production, Theoretical analysis, Growth rates. cal analysis, Growth rates.

This paper develops a dynamic theory for optimally managing renewable resources such as fish, whale, deer or forests, to prevent their extinction while insuring adequate supply levels for human consumption. The optimal policy, which maximizes total harvest, consists of a no-harvest period followed by harvesting at maximum allowable rates. This policy corresponds to a seasonal harrates. This policy corresponds to a seasonal har-vesting law, where each year harvesting is allowed only during a certain 'hunting or fishing' season. Regulating withdrawal rates is not necessary as long as regulations on terminal populations are imposed. Withdrawal rates are then set by the maximum technologically feasible rate, automati-cally limiting harvesting periods. Policies obtaining maximum sustainable yield are not optimal since they lead to early species extinction and do not result in maximum total harvest. Seasonal harvesting meets several requirements; it does not exceed technological or conservational considerations; it results in resource population levels conserved at the end of a given time horizon; it maximizes total unantity harvested. Regulatory, a maximize total unantity harvested. Regulatory agencies face prob-ems determining and recommending maximum al-owable harvesting intensities that will sustain adequate species levels for continued growth. The producing sector faces problems determining an optimal withdrawal policy that maximizes production without violating regulatory agency requirements. The model takes into account the interplay between production sector and regulatory agency policies. (Danovich-Wisconsin) W80-00994

COST-BENEFIT ANALYSIS AND ENVIRON-MENTAL EFFECTS, Ecole Polytechnique, Paris (France). P. Bohm, and C. Henry. Ambio, Vol 8, No 1, p 18-24, 1979. 5 Fig, 5 Ref.

Descriptors: \*Cost benefit analysis, \*Cost benefit theory, \*Decision making, \*Environmental effects, France, United States, Case studies, Risks, Water pollution, Air pollution, Forests, Oil industry, Oil refinery, Political aspects, Hydroelectric plants, Hell's Canyon(ID).

Cost-benefit analysis (CBA) is used in three case Cost-benefit analysis (CBA) is used in three case studies to illustrate its value in reducing a problem with multi-dimensions to one with fewer dimensions, thus making the problem more manageable. CBA also can insure that no particular aspect is unduly favored or ignored and that uncertainties, individual contents of the contents of indivisible concerns, risk premiums, irreversibility, and option value are taken into account. Because CBA examines relevant questions and gives appro-priate weight to both the institutional framework and to distribution of benefits and costs among various affected publics, it helps the environmental considerations to political decision making. The problems considered are: (1) whether or not an oil refinery should be constructed in an unpolluted fishing and marine life zone in Roadstead Bay of Brest, France; (2) whether a highway connecting the suburbs of Paris should be allowed to cross the beautiful forests of Malmaison, Versailles, etc.; and (3) whether or not unique Hell's Canyon, in the (3) whether or not unique riefs Canyon, in the United States should be used for a hydroelectric dam. These case studies show difficulties which arise where decisions are made without analysis, or with analysis but without an overall perspective. (Luedtke-Wisconsin) W80-00995

WATER POLLUTION CONTROL THEORY --AN ECONOMIC TAXONOMY.

Newcastle-upon-Tyne Univ. (England). Dept. of D. J. Storey, and M. Walker.

Journal of Environmental Management, Vol 7, No
3, November 1978, p 205-217. 8 Fig, 31 Ref.

Descriptors: \*Planning, \*Water pollution control, \*Standards, \*Economics, Non-structural alternatives, Regulation, Administrative agencies, Water quality standards, Water policy, Theoretical analysis, Methodology, Water policy, Pollution taxes(Charges), Costs, Benefits, Effluents.

A framework is suggested within which various 'best' policies for controlling discharge of polluting material to natural waterways may be compared objectively. The framework, distinguishing between decisionmaking information generated prior to the setting of the standard and choice of policy to the setting of the standard and choice of policy as opposed to information generated by observa-tion of policies in operation, suggests that comparison of policies should take place on the basis of efficiency, equity and effectiveness. The taxonomy has three aims: (1) It is intended to ensure that economists evaluating water pollution control policies examine all the criteria outlined in the evalua-tion process. (2) It serves to highlight, under un-certainty, the impossibility of divorcing standards-setting from an evaluation of control policies. (3) It setting from an evaluation of control policies. (3) it demonstrates that in most cases, some estimates of likely benefits of improvement are necessary because of the likelihood of clashes between criteria and sub-criteria. Only by applying the taxonomy in detail to individual control schemes is it possible to evaluate fully the merits of charging, subsidies, shares schemes or regulation. In demonstrating the evaluate fully the ments or charging, subsidies, shares schemes or regulation. In demonstrating the taxonomy, differences are graphically illustrated between the traditional and adaptive models of decisionmaking. Both models begin the collection of a priori information from benefit-cost analysis, then follow through with phosping, strategy, see then follow through with choosing a strategy, se-lecting a policy, and implementing to achieve a standard. But in the adaptive model, there is an inerative step in which strategies and policies are revised after a posteriori information is collected. (Harris-Wisconsin)

INVESTING RETURNS FROM DEPLETING RENEWABLE RESOURCE STOCKS AND IN-TERGENERATIONAL EQUITY

Queen's Univ., Kingston (Ontario). J. M. Hartwick

Economic Letters, Vol 1, No 1, p 85-88, 1978. 8

Descriptors: \*Economics, \*Investment, \*Natural resources, \*Mathematical models, \*Equity, Capital, Resources, Equations, Model studies, Dynamic programming, Fish stocking, Forestry, Mineralogy, Production, Resource allocation, Social aspects, Exploitation, Mathematical studies.

Per-capita consumption will remain constant over time (assuming no changes in technology or population) if along dynamically efficient development lation) if along dynamically efficient development paths, net current diminution natural resource stocks value, renewable and non-renewable, is invested in reproducible capital. A savings-investment rule, investing current exhaustible resource rents in reproducible capital, leads to intergenerational equity in that per-capita consumption remains constant across generations in a large situation range. This rule is valid for stocks of renewable resources such as fish and forest stocks, as well as non-renewable resources, such as minerals. A mathematical model is proposed with four went as non-renewable resources, such as minerais.

A mathematical model is proposed with four inputs into production: reproducible capital, mineral resource flows, renewable resource flows, and labor. If all inputs are held constant except one, an increase in that stock implies it will be less costly for later generations to exploit it, and vice-versa for stock declines. A combination of renewable and exhaustible resources leads to the non steadyand exhaustible resources leads to the non steady-state character of the efficient equitable path. Paths are sensitive to the substitutability of resource flows and reproducible capital. Constant per-capita consumption, as a result of technical progress equalling population growth rate, does not hold in the proposed model with renewable resources. (Danovich-Wisconsin) W80-00997

CALIFORNIA WATER PLANNING AND POLICY: SELECTED ISSUES, For primary bibliographic entry see Field 6E. W80-01000

ECONOMICS OF WEATHER MODIFICATION: A REVIEW, Illinois State Water Survey, Urbana.

S. T. Sonka. S. 1. Sonka.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-110398, Price codes: A04 in paper copy, A01 in microfiche.
Report of Investigation 89, 1979. 57 p, 3 Fig, 14 Tab, 67 Ref. NOAA 7-14291.

Descriptors: \*Weather modification, \*Economics, Descriptors: "Weather modification," Economics, Reviews, "Economic impact, Cost-benefit analysis, Rainfall, Hurricanes, Meteorology, Cloud seed-ing, Costs, Indirect costs, Agriculture, Recreation, Construction, Water supply, Transportation, Hail suppression, Precipitation augmentation, Snow-pack enhancement.

This report discussed gross benefits and costs of potential weather modification activities and the elements vital to a credible economic analysis of elements vital to a credible economic analysis of such activities. It reviewed and evaluated more than 60 existing studies relating to the economic impacts of 5 major modification activities; precipitation augmentation including snow-pack enhancement, hail suppression, hurricane suppression, fogispersal, and lightning suppression. Because weather can have severe adverse effects on economic activity, gross benefits of modification appear very high in relation to most operational costs. However, indirect costs may be great, and, in general, those adversely affected are not the same individuals enjoying the gross benefits of weather modification requires consulting with at-

#### Field 6-WATER RESOURCES PLANNING

# **Group 6B—Evaluation Process**

mospheric scientists to assure understanding of the physical factors involved, funding for a considerable amount of data gathering, considering effects of possible future changes in crucial factors, and orienting the analytical viewpoint to both negative and positive regional economic impacts. Most of and positive regional economic impacts. Most of the existing literature relating to the economics of weather modification addresses precipitation aug-mentation and hail suppression; very few attempts toward comprehensive economic analyses have been made. More is known about the economic impacts of weather on agriculture than for any other activity area. Probably the most important aspect in determining the credibility of any ecoaspect in determining the creationity of any eco-nomic analysis, however, is the viewpoint of that analysis. In conducting such an analysis, it should be clear that the goal of the analysis is to determine the effects of the modification activity on the entire economy of a region, not just impacts on those sectors which derive benefits from the planned activity. (Humphreys-ISWS) W80-01008

## 6D. Water Demand

AN ACTIVITIES MODEL OF CONSUMER BE-HAVIOUR WITH SPECIAL REFERENCE TO OUTDOOR RECREATION, Australian National Univ., Canberra. Centre for Resource and Environmental Studies.

A. M. Ulph, and I. K. Reynolds. Scottish Journal of Polytical Economy, Vol 26, No 1, p 33-60, February 1979. 1 Fig, 40 Ref.

Descriptors: \*Travel cost method, \*Willingness-to-pay, \*Cost benefit analysis, \*Recreation demand, Model studies, Recreation, Recreation facilities, Reviews, Theoretical analysis, Evaluation, Social participation, Visits, Parks, Costs, Benefits, Meth-colology, Decision method. odology, Decision making.

Travel cost methods are used to study factors which effect demand for outdoor recreation facili-ties or modes of transport, and as analytical tech-niques in cost-benefit studies of new projects. A general theoretical framework is developed to general theoretical tramework is developed to access the wide variety of methods employed by researchers using travel cost methods to evaluate recreation benefits, and to provide a more consist-ent travel cost approach. The general model indi-cates that money costs which should be considered in a travel cost analysis are the cost of on-site goods and services consumed and expenditure on goods and services made while travelling, essentially gas and car services. Other independent demand variables are analyzed including income demand variables are analyzed including income and the prices of substitute activities. Additional needs not fully covered by the model are also discussed. There is a need to consider the sequence of decision involved in undertaking outdoor recreation including how many sites to visit, how long to spend at each site, and whether or not to under-take a trip at all. A characteristic approach should be used to examine new sites or changes in the management for existing sites instead of the activities approach. Last, compensated rather than un-compensated demand curves are needed. All of these developments must be incorporated into the model simultaneously. (Luedtke-Wisconsin) W80-00992

WATER RESOURCES AND INDUSTRIAL DE-VELOPMENT IN MISSISSIPPI: OPPORTUNI-TIES AND CONSTRAINTS,

Mississippi Univ., University. Bureau of Business and Economic Research.

W. Hollman, S. C. Shull, R. S. Glaze, and S. A.

Simmons. Available from the National Technical Information Service, Springfield, VA 22161 as PB80-110877, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute, Mississippi State University, Mississippi State, Report, September, 1979, 58 p. 12 Tab, 70 Ref. OWRT A-128-MISS (1). 14-34-0001-9026.

Descriptors: \*Industrial water, \*Economic impact, \*Mississippi, Regression analysis, Water supply, Water law, Water demand, Water resources devel-Water law, opment, Multivariate analysis, Water conflicts,

Economic planning, Industrial development, Source of supply.

The recent increase in industrialization and urbanization in the State of Mississippi has begun to tax water supplies in some areas of the state. Concurwater supplies in some areas of the state. Concurrently, state and local agencies and elected officials are becoming increasingly involved in the solicitation of new and expanded industrial development within the state. The supply and availability of water resources should be a major concern of those officials as well as of private industrial decision makers, particularly those whose production techniques require substantial quantities of water or water of specified quality. This study accumu-lated data on industrial water demands in Mississippi through a questionnaire survey of 585 manufac-turing firms in the State. Firms were questioned turing firms in he State. Tims were questioned about water use and discharge characteristics and recent conflicts (if any) over the use of water. Also, procedures were developed to estimate future industrial water requirements through the use of a multiple regression model. Findings are presented in tabular form to facilitate comprehensipresented in tabular form to facilitate comprehensi-bility. The knowledge uncovered and tools devel-oped in the study will aid in the development of meaningful decision rules in the planning process which reflect the physical, economic, legal, and social aspects of water management in Mississippi. W80-01003

ALPINE LAKES IN KINGS CANYON NATION-AL PARK, CALIFORNIA BASELINE CONDI-TIONS AND POSSIBLE EFFECTS OF VISITOR

California Univ., Berkeley. Dept. of Forestry and Conservation or primary bibliographic entry see Field 5C.

## 6E. Water Law and Institutions

W80-01116

MILITARY USES OF OCEAN SPACE AND THE DEVELOPING INTERNATIONAL LAW
OF THE SEA: AN ANALYSIS IN THE CONTEXT OF PEACETIME ASW,
Department of Agriculture, Washington, DC. Forelling Agriculture Div.
R. J. Zedalis.

San Diego Law Review, Vol 16, No 3, p 575-644,

Descriptors: \*International law, \*Submarines, \*United nations, \*Military aspects, Law of the sea, International waters, Conferences, Legal aspects, Governments, Regulation.

The international legal prescriptions regulating peacetime military uses of ocean space other than passage through straits used for international navipassage inrough straits used for international navi-gation are analyzed. More specifically, the focus is on peacetime anti-submarine warfare (ASW), con-ducted below the navigable water surface. The legal regions of the 1958 Geneva Convention on the Law of the Sea and the Third United Nations Conference on the Law of the Sea (UNCLOS III). Conference on the Law of the Sea (UNCLOS III), are compared as to the following subject areas: (1) the internal waters and territorial sea; (2) the high sea; (3) the continguous zone; (4) the exclusive economic zone; and (5) the deep seabed. The negotiating texts produced at UNCLOS III provide a more desirable legal regime. As to military use of the ocean's seabed and surface, the proscriptive regime of UNCLOS III allows easy verification of state observance. (MacGregor-Florida) W80.00801 W80-00801

MONOPOLY-POWER AS A MEANS FOR POL-LUTION CONTROL.

A. Endres.
The Journal of Industrial Economics, Vol 27, No 2, p 185-187, December 1978. 5 Ref.

Descriptors: \*Water pollution control, \*Monopoly, Equations, Optimization, Competition, Taxes, Industries, Pollution abatement, Marginal costs.

Monopoly power never corrects allocative failures of external diseconomy because monopolists do

not use efficient input mixes. This paper compares not use efficient input mixes. This paper compares perfectly competitive polluting firms and damaged firms in Pareto-optimal situations. If perfectly competitive polluting industry firms are forced by taxes to bear marginal damages they cause, Pareto-optimal output and pollution level will be produced. If monopolists take over competitive polluting industry, the same output and pollution levels are produced as perfectly competitive industries, regulated by Pignovian taxes. However, no incentives exist for unresultate polluting monopolists to exist for unregulated polluting monopolists to employ any resources in additional abatement methods. Therefore, since taxes on perfectly competitive economies produce less output, monopoly power as a means for pollution abatement is just as inefficient. (Danovich-Wisconsin)

C se stid S v a si is h c d

THE STANISLAUS RIVER DRAINAGE BASIN AND THE NEW MELONES DAM: HISTORI-CAL EVOLUTION OF WATER USE PRIOR-ITIES

ITIES, California Univ., Davis. Dept. of History. W. T. Jackson, and S. D. Mikesell. Available from the National Technical Information Service, Springfield, VA 22161 as PB80-110828, Price codes: A09 in paper copy, A01 in microfiche. Contribution 178, California Water Resources Center, University of California, Davis. June 1979, 184 p. 10 Fig. 10 Tab. (California Water Resources Center Project UCAL-WRC-W-524).

Descriptors: "History, "Rivers, "Jurisdiction, "Federal-State water rights conflicts, "Planning, "Decision making, Priorities, Governments, Constraints, Political constraints, Institutional constraints, Water districts, Attitudes, Motivation, Social aspects, Political aspects.

The evolution of water use priorities for the Stanislaus River goes beyond the highly-publicized contest of the 1970s between the federal water agencies and the environmentalists over construction of the New Melones project. Since the 1850s, plans for development of the Stanislaus River have for development of the Stanislaus River have passed through several distinct phases, each re-flecting the prevailing values and objectives. These phases, analyzed topically and chronologically in this report, include: a private phase, dominated by mining-related and subsequently by the electric utility interests; a local phase, dominated by irriga-tion districts, culminating in construction of the Tri-Dam Project in the late 1950s; an early federal phase, in which the Bureau of Reclamation and the Corres of Engineers competed for intridiction for Corps of Engineers competed for jurisdiction for the New Melones Dam; a phase of federal-state the New Melones Dam; a phase of recera-state cooperation, in which numerous federal and state agencies negotiated for the best design for the New Melones project; an opposition phase, in which the environmentalists criticized the New Melones project; and a period of stalemate in the 1970s, in which levels federal the project is not appeared to the project; and a period of stalemate in the 1970s, in which levels federal the project is not provided in the project in the project in the project is not provided in the project in t which intense private opposition, high-level feder-al-state conflict, and persistent litigation in federal court have precluded full operation of the com-pleted new melones project. (Snyder-Cal) W80-00999

CALIFORNIA WATER PLANNING AND POLICY: SELECTED ISSUES, Available from the National Technical Information Service, Springfield, VA 22161 as PB80-110349, Service, Springneia, VA 22101 as Pabol-110349, Price codes: Al2 in paper copy, A0I in microfiche. Water Resources Center, California University, Davis, June 1979, 251 p. 15 Fig, 31 Tab, 1 Append. OWRT A-999- CAL (15).

Descriptors: \*Planning, \*Water Resources, \*Water resources development, \*Project planning, Long term planning, Projections, Research and development, Legislation, Administration, Droughts, Decision making, Management, Research priorities, Alternate planning, Regional development, Cali-

This volume grows out of research and seminars sponsored by the University of California to ad-dress some of the major issues of California water planning and policy. Its purpose is to provide information and evaluation for selected water problems for State legislative and administrative officials and for others who are involved with

Data Acquisition—Group 78

er compares and damaged fectly comced by taxes Pareto-opti-produced. If uting indusels are pro-ies, regulat-incentives iopolists to abatement fectly com-, monopoly

GE BASIN HISTORI-E PRIOR-

Information B80-110828, microfiche.
Resources
June 1979,
r Resources

Jurisdiction, \*Planning, ments, Contional con-Motivation.

r the Stanislicized conwater agen-nstruction of 1850s, plans River have es, each reologically in ominated by the electric ed by irriga-ction of the early federal ation and the isdiction for federal-state ral and state for the New in which the the 1970s, in -level federon in federal of the com-(le

ING AND Information PB80-110349, microfiche. University, b, 1 Append.

rces, \*Water nning, Long and develop-roughts, Dech priorities,

and seminars fornia to adifornia water to provide lected water dministrative

California's decision-making system for water resources. Participating in the seminars were representatives of business, labor, governmental, educational and civic organizations. At the first three-day seminar held at the University of California, and the University of California and the Un day seminar held at the University of California, Santa Cruz, in May 1978, seminar participants reviewed the range of California Water problems and selected ten priority issues for further policy study. Public policy papers were prepared on these issues and discussed at a second three-day seminar held in Asilomar in March 1979. This volume is composed of the public policy papers which were discussed at the Asilomar Seminar. All of the papers are organized around four headings, namely (1) Statement of the Problem (2) Background, (3) Policy and Program Alternatives and (4) Suggested Program for Research and Action. (Snyder-Calif) W80-01000

EMERGENCIES IN WATER DELIVERY, California Univ., Irvine. School of Enginee For primary bibliographic entry see Field 7A. W80-01001

MAR DEL PLATA ACTION PLAN, For primary bibliographic entry see Field 6A. W80-01109

## 6G. Ecologic Impact Of Water Development

ECONOMIC IMPACT OF THE SELENIUM EF-FLUENT STANDARD IN ILLINOIS (R76-21), Northern Illinois Univ., De Kalb. Dept. of Geolo-For primary bibliographic entry see Field 6B. W80-00989

PARTIAL DROUGHT CONDITIONS IN NEPAL,
Ground Water Resources Development Board,
Kathmandu (Nepal).
For primary bibliographic entry see Field 2B.
W80-01033

# 7. RESOURCES DATA

#### 7A. Network Design

WATER-RESOURCES INVESTIGATIONS IN KANSAS, 1978, Geological Survey, Lawrence, KS. Water Resources Div. Geological Survey Water-Resources Investigations in Kansas Folder, 1979. 1 Sheet.

Descriptors: \*Water resources, \*Investigations, \*Inter-agency cooperation, \*Kansas, Surveys, Planning, Hydrologic data, Basic data collections, Precipitation(Atmospheric), Streamflow, Runoff, Sediment yield, Groundwater, Water quality, Onsite investigations, Dissolved solids, Bibliographies, Networks, Maps, \*Cooperative water-studies pro-

Water-resources studies and investigations in Kansas made by the U.S. Geological Survey in cooperation with State and local agencies are summarized. A bibliography of selected material concerning these investigations is included. The investigations include collections of basic information through a hydrologic-data network, areal hydrologic through a hydrologic-data network, areal hydrologic or interpretative studies, and research projects. The hydrologic-data network consists of primary, secondary, and water management streamflow stations; ground water observation wells; and water quality observation sites. Small State maps show mean annual precipitation, mean annual runoff, annual mean sediment yields of streams, principal sources of ground water, discharge of principal rivers, and the dissolved solids in streams. A larger map shows by symbols, numbers, and colored outline the hydrologic-data network and investigations in Kansas as of October 1977. (Woodard-USGS) USGS)

W80-00944

A NOTE ON THE DUAL-GAGE AND WYO-MING SHIELD PRECIPITATION MEASURE-MENT SYSTEMS,

Science and Education Administration, Boise, ID. Northwest Watershed Research Center. For primary bibliographic entry see Field 2B. W80-00957

STATISTICAL EVALUATION OF SAMPLING FREQUENCIES IN MONITORING NET-WORKS,

Colorado State Univ., Fort Collins.

R. C. Ward, J. C. Loftis, K. S. Nielsen, and R. D.

Journal of Water Pollution Control Federation, Vol 51, No 9, p 2292-2300, September 1979. 1 Fig, 1 Tab, 11 Ref.

Descriptors: \*Monitoring, \*Water sampling, \*Water quality, \*Statistical models, Evaluation, Analytical techniques, Networks, Frequency, Variability, Statistics, Quality control, Correlation analysis, Stochastic processes, Sampling frequency.

analysis, Stochastic processes, Sampling frequency. Recent events in regulatory water quality monitoring have permitted a refinement in the goals for monitoring networks. This paper described a procedure that incorporates basic statistics into the evaluation of sampling frequencies in these monitoring networks. The procedure attempts to obtain uniform levels of information from all stations by allocating samples to each station based on its proportional variation in quality relative to the total variation in the network. A means of measuring the overall improvement in uniformity of information was developed. In applying the procedure to Colorado's San Juan Basin monitoring network, a 31.43% improvement in uniformity was obtained by allocating samples based on water quality variation rather than by simply allocating an equal number of samples to all stations. As future research is performed in developing more thorough evaluation procedures, it was recommended that the practical application not be forgotten. This will require knowledge of the type and level of statistics being used on a practical basis by the many water quality management agencies and carefully building on it. (Humphreys-ISWS)

EMERGENCIES IN WATER DELIVERY,
California Univ., Irvine. School of Engineering.
R. Schinzinger, and H. Fagin.
Available from the National Technical Information
Service, Springfield, VA 22161 as PB80-110372,
Price codes: A07 in paper copy, A01 in microfiche.
Contribution 177, Water Resources Center, Calif.
Univ., Davis. June 1979, p 131, 33 Fig. 16 Tab, 1
Append. (California Water Resources Center Project UCAL-WRC-W-498). OWRT-B-178-CAL (8).

Descriptors: \*Water supply, \*Water delivery, \*Disasters, \*Failures, \*Potential water supply, Planning, Alternative planning, Civil defense, Water conveyance, Structures.

Severe impacts could result from an interruption of Severe impacts could result from an interruption of long water supply lines for which continuous fault free operation is too often taken for granted. The need for contingency planning-which encompasses not only preparations in anticipation of a disaster event but also operations during an emergency-is emphasized. The stage is set by a review of water needs in residential, institutional, industrical and excluding the processing the stage of the processing the al, and agricultural use as well as both a discussion of the nature of disasters with particular attention to public response and the vulnerability of water systems. The emergency operations which are investigated include: recognition of an emergency, communication and coordination, allocation mechanisms. communication and coordination, allocation mechanisms, the effect of rate structures, restoration policies, and mutual assistance. Throughout the study a particular, medium-sized water agency in the San Diego region is cited as an example, but the use of generalized models extends the applicability of the findings. (Snyder-Calif) W80-01001

# 7B. Data Acquisition

APPLICATION OF TRANSIENT-FLOW MODEL TO THE SACRAMENTO RIVER AT SACRAMENTO, CALIFORNIA, Geological Survey, Menlo Park, CA. Water Re-sources Div. For primary bibliographic entry see Field 2L. W80-00940

A NOTE ON THE DUAL-GAGE AND WYO-MING SHIELD PRECIPITATION MEASURE-MENT SYSTEMS, Science and Education Administration, Boise, ID. Northwest Watershed Research Center. For primary bibliographic entry see Field 2B. W80-00957

RADAR MEASUREMENT OF RAINFALL—A SUMMARY, National Center for Atmospheric Research, Boul-der, CO.

For primary bibliographic entry see Field 2B. W80-01036

THE FRONTIERS PLAN: A STRATEGY FOR USING RADAR AND SATELLITE IMAGERY FOR VERY-SHORT-RANGE PRECIPITATION

FOR VERY-SHORT-RANGE PRECIPITATION FORECASTING, Royal Signals and Radar Establishment, Malvern (England). Radar Research Lab. For primary bibliographic entry see Field 2B. W80-01038

INTEGRATED COMPUTER-BASED DATA ACQUISITION SYSTEM UTILISING RADIO COMMUNICATIONS, Aqua-The Journal of the International Water Supply Association, No 4, p 3-10, 1979. 6 Fig.

Descriptors: \*Telemetry, \*Data collections, \*Data transmission, \*Electronic equipment, Groundwater, Wells, Water wells, Water levels, Rivers, River flow, Flood warning, Water pollution, Water resources, Rainfall, Radio communication systems, Radio waves, Microwaves, Monitoring, Remote sensing, Data acquisition systems.

This article describes at a basic level the techniques employed in wide area computer-based telemetry schemes utilising radio communications. An integrated system design approach, with regard to the main elements of communications, outstations, and control centres, is illustrated by a comprehensive data acquisition system currently being implemented for the Thames Water Authority Great Britain by Plessey Radar Limited. (Sims-ISWS)

STOCHASTIC WATER QUALITY MODEL,
Auburn Univ., AL. Dept. of Civil Engineering.
L. C. Bell.
In: Verification of Mathematical and Physical
Models in Hydraulic Engineering. Proceedings of
26th Annual Hydraulics Division Specialty Conference, University of Maryland, College Park,
Maryland, August 9-11, 1978. p 638-644 (1978)
American Society of Civil Engineers. New York,
N.Y.

Descriptors: \*Wastes, \*Receiving streams, \*Dissolved oxygen, Model studies, Path of pollutants, \*Stochastic water quality model, DOSIM.

Water quality planners have traditionally relied heavily on deterministic (non-probabilistic) computer models to predict the effects of alternate waste load criteris on receiving streams and rivers. Computer programs such as STREM and DOSAG-I have been used to determine stream dissolved oxygen concentrations under arbitrary or assumed headwater, stream, and effluent conditions. No attempt is made to determine the probability of occurrence of the computed dissolved oxygen concentrations. Researchers at Auburn University applied deterministic water quality models to 33 stream segments throughout the State

## Field 7—RESOURCES DATA

## **Group 7B—Data Acquisition**

of Alabama in 1974 and 1975 (1). This experience led to the conclusion that the highly variable conditions normally encountered in small creeks and streams could be simulated more accurately using a stochastic water quality model. W80.01163

UTILIZING AN INFRARED THERMOMETER FOR AIR TEMPERATURE MEASUREMENTS, Minnesota Univ., St. Paul. Dept. of Agricultural

Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
S. G. Grannes, D. C. Slack, and E. R. Allred. Paper No 78-2548, presented at 1978 Winter meeting American Society of Agricultural Engineers, Chicago, ILL., Dec. 18-20, 1978. 19 p. 5 Fig. 1 Tab, 10 Ref, ASAE, St. Joseph, Michigan. OWRT A-037-MN (1).

Descriptors: \*Air temperature, \*Measurement, \*Evapotranspiration, \*Analytical techniques, Instrumentation, Evaluation, \*Infrared thermometer.

A system for determining air temperature with an infrared thermometer has been developed. This method utilizes a shielded black body emitter as an atmospheric temperature reference. The emitter has been shown to approach air temperature to within 0.13oC. This measurement system is especially useful in convective heat exchange studies between naturally exposed surfaces and the atmosphere. (Blake-Minn) W80-01200

#### 7C. Evaluation, Processing and Publication

WATER RESOURCES DATA FOR VIRGINIA, WATER YEAR 1978,

Geological Survey, Richmond, VA. Water Re-

Geological Survey Water-Data Report VA-78-1, June 1979, 413 p, 4 Fig, Append.

Descriptors: \*Virginia, \*Hydrologic data, \*Surface waters, \*Groundwater, \*Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Water resources data for the 1978 water year for Virginia consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 197 gaging stations, stage only at 1 gaging station, stage and contents at 9 lakes and reservoirs, water quality at 44 gaging stations, and water levels at 63 observation wells. Also included are data for 69 crest-stage partial-record stations. Locations of these sites are shown on maps. Additional water data were collected at various sites not involved in the systematic data-collection program and are the systematic data-collection program and are published as miscellaneous measurements and analyes. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Virginia. (Woodard-USGS) W80-00932

MAPS SHOWING GROUND-WATER CONDI-TIONS IN THE NEW RIVER-CAVE CREEK AREA, MARICOPA AND YAVAPAI COUN-TIES, ARIZONA-1977, Geological Survey, Tucson, AZ. Water Resources Div.

G. R. Littin. Geological Survey Water Resources Investigation open-file report 79-1068 June 1979. 2 Sheets, 10 Ref.

Descriptors: \*Groundwater, \*Maps, \*Water wells, \*Water levels, \*Water quality, Specific conductivity, Fluoride, Aquifers, Geology, Arizona, \*Maricopa County(AZ), \*Yavapai County(AZ), New River Area(AZ), Cave Creek Area(AZ).

The New River-Cave Creek area includes about 500 square miles in central Arizona. The ground-

water conditions vary greatly owing to large dif-ferences in rock type and extent of fracturing. Information shown on the maps includes depth to water, altitude of the water level, well depth, and specific conductance and fluoride concentration in the water. Scale 1:125,000. (Woodard-LISGS) the water. Scale 1:125,000. (Woodard-USGS) W80-00933

CONFIGURATION OF THE TOP OF THE FLORIDAN AQUIFER, SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT AND ADJACENT AREAS, Geological Survey, Tallahassee, FL. Water Re-

sources Div

A. Buono, and A. T. Rutledge.
Geological Survey Water-Resources Investigations 78-34 (open-file report), June 1979. 1 Sheet, 17 Ref.

Descriptors: \*Maps, \*Aquifers, \*Geohydrologic units, \*Elevation, \*Wellpoints, Contours, Hydro-geology, Water wells, Florida, \*Floridan aquifer, Southwest Florida Water Management District.

This map depicts the approximate top of the rock that composes the Floridan aquifer. The contours represent the elevation of the top of the Floridan aquifer to mean sea level. Rock units recognized to be part of the Floridan aquifer are limestone and dolomite ranging from middle Eocene to early dolomite ranging from middle Eocene to early Miocene. They are Lake City Limestone, Avon Park Limestone, Ocala Limestone, Suwannee Limestone, and Tampa Limestone. In this report, the top of the Floridan aquifer is a limestone defined as the first consistent rock of early Miocene age or older below which occur no clay confining beds. Although the Hawthorn formation of middle Miocene is considered part of the Floridan aquifer when it is nighted by Miocene contact. dan aquifer when it is in direct hydrologic contact with lower lying rock units, it is not considered here because of a lack of detailed delineation of areas where contact exists. (Woodard-USGS) W80-00934

WATER RESOURCES DATA FOR NORTH CAROLINA, WATER YEAR 1978, Geological Survey, Raleigh, NC. Water Resources

Geological Survey Water-Data Report NC-78-1, March 1979. 515 p, 4 Fig.

Descriptors: \*North Carolina, \*Hydrologic data, \*Surface waters, \*Groundwater, \*Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for North Carolina consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and ground-water levels. This report contains discharge records for 148 gaging stations, stage and contents for 24 lakes 148 gaging stations, stage and contents for 24 lakes and reservoirs, water quality for 146 gaging stations, and water levels for 59 observation wells. Additional water data were collected at various sites, not involved in the systematic data-collection program, and are published as miscellaneous measurements in this report. The collection of water-resources data in North Carolina is a part of the National Water-Data System operated by the U.S. Geological Survey in cooperation with State, municipal, and Federal agencies. (Woodard-USGS) W80-00393 W80-00939

WATER-RESOURCES INVESTIGATIONS IN **KANSAS, 1978,** 

Geological Survey, Lawrence, KS. Water Resources Div. For primary bibliographic entry see Field 7A. W80-00944

PUBLIC GROUNDWATER SUPPLIES IN CAR-

ROLL COUNTY,
Illinois State Water Survey, Urbana.
D. M. Woller, and E. W. Sanderson.
Available from the National Technical Information
Service, Springfield, VA 22161 as PB80-110836,
Price codes: A03 in paper copy, A01 in microfiche.

ISWS Bulletin 60-28, 1979, 23 p. 3 Fig.

Descriptors: \*Water supply, \*Illinois, \*Ground-water resources, Unconsolidated aquifers, Well data, Gravels, Sand aquifers, Bedrock, Sandstones, data, Gravels, Sand aquiters, Bedrock, Sandstones, Dolomite, Groundwater availability, Groundwater, Hydrology, Hydrogeology, Water sources, Water quality, Water wells, Municipal water, Water yield, Water properties, Hardness(Water), Chemical properties, Deep wells, Shallow wells, Geology, Aquiters, "Carroll County(IL), Dissolved minerals, Water bearing formations.

All available information on production wells used All available information on production wells used for public groundwater supplies in Carroll County, Illinois, was presented. The definition of public water supply as contained in the Environmental Protection Act of 1970 was used to determine those water systems and wells to be included. The those water systems and wells to be included. The report included separate descriptions for ground-water supplies of 7 municipalities and 1 state park in Carroll County. These were preceded by brief summaries of the groundwater geology of the county and the development of groundwater sources for public use. Individual production wells for each supply were described in the order of their construction. The description for each well included the equifier or acquire; tenned determined the supplier or acquire; tenned the supplier or acquired to the supp included the aquifer or aquifers tapped, date drilled, depth, driller, legal location, elevation in feet above mean sea level, log, constructionfeatures, yield, pumping equipment, and chemical analyses. (Humphreys-ISWS)

COMPUTER APPLICATION TO DOUBLE-MASS ANALYSIS,

MASS ANALYSIS, Asian Inst. of Tech., Bangkok (Thailand). Div. of Water Resources Engineering. B. K. Panigrahi, and A. D. Gupta. Water Resources Bulletin, Vol 15, No 4, p 1168-1172, August 1979. 2 Fig, 1 Tab, 2 Ref.

Descriptors: \*Mass curves, \*Computer programs, \*Model studies, \*Hydrology, Hydrological data, Analytical techniques, Analysis, Data processing, Mathematical models, Foreign research, \*Thai-

Double-mass analysis for checking consistency of a hydrological record is considered to be essential before taking it for analysis purpose. Because of increasing computer application in hydrological analyses, in this paper a simple and efficient method for the double-mass checking was developed. The problem has been formulated in FOR-TRAN IV language, and the basic 'steps and a computer output of the program were presented in a flow chart and a table. The analysis has been successfully applied to a number of data sets of different river basins of Thailand and Taiwan. From a comparison with manual graphical analysis for the data sets, it was concluded that this analysis shows satisfactory agreement with much saving of shows satisfactory agreement with much saving of time. (Humphreys-ISWS)
W80-00970

HYDROMETEOROLOGICAL CHARACTERISTICS OF SEVERE RAINSTORMS IN ILLI-

Holinois State Water Survey, Urbana. For primary bibliographic entry see Field 2B. W80-01009

## 8. ENGINEERING WORKS

#### 8A. Structures

LAKE PUMP SUCTION MECHANISM,

Descriptors: \*Patents, \*Pumping, \*Water delivery, Water sources, Water storage, Bodies of water, Lakes, Equipment, Pumps, Suction pumps.

A suction mechanism is submerged underwater in lake. It is designed to eliminate sand and mud

Hydraulics-Group 8B

from entering a foot valve connected to hoses for pumping water out of the lake for use. The suction mechanism includes the foot valve at the upper end of a vertical suction pipe. The foot valve is covered by a protective dome. A horizontal anchor stand supports the suction pipe vertically as well as the lines leading from the lake including a suction pipe and a pressure pipe. (Sinha-OEIS) W80-00880 \*Groundfers, Well Ground-Ground-er sources, al water,

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S

MULTI-WALLED BREAKWATER,

T. Ijima.

T. Ijima.

U.S. Patent No 4,154,548, 12 p, 19 Fig, 5 Ref;
Official Gazette of the United States Patent Office,
Vol 982, No 3, p 987, May 15, 1979.

Descriptors: \*Patents, \*Breakwaters, Engineering structures, Sea walls, Shore protection, Coasts, Harbors.

The invention provides a sea wall having effective blocking ability against a variety of waves having a wide range of wave lengths. The breakwater has a base on the water bottom and a back wall which stands on the base and rises above the water level. A number of front walls which stand on the base are separated from one another and have the same are separated from one another and have the same height as the back wall. A support slab projects horizontally from the top end of the back wall and is connected to the top ends of the front walls. Each front wall is pierced by holes, the dimensions of the holes of the front walls decreasing monotonically from the first wall situated at the front of the breakwater to the last wall closet to the back wall. (Sinha-OEIS) W80-00893

PROCESS FOR BUILDING UP TOWERS, PAR-TICULARLY WATER TOWERS, Le Ciment Arme Demay Freres, Marne (France).

(Assignee).

(Assignee).

J. de Leaumont.

U.S. Patent No 4,155,210, 11 p, 14 Fig, 9 Ref;
Official Gazette of the United States Patent Office,
Vol 982, No 4, p 1207, May 22, 1979.

Descriptors: \*Patents, \*Structures, \*Structural design, Structural shapes, Water storage, Storage tanks, Modular structure, Water towers.

A process is provided where molds corresponding to the length of the elements are achieved, and afterwards the molds are subdivided so as to make afterwards the molds are subdivided so as to make only segments corresponding to a portion of each element. The size of the segments are selected to allow handling. Then the elements are selected to allow handling. Then the elements are subdivided into segments when molding is performed. Thus it is possible to achieve towers consisting of modular elements which can be industrially achieved on the ground. In another characteristic feature of the invention, the lateral edges of the elements (or of the segments constituting the elements) are provided with grooves. The grooves are designed to cooperate one with another so as to make channels designed to receive concrete, glue or any water-proof means. (Sinha - OEIS) W80-00900

FILLING AND EMPTYING SYSTEM FOR BAY SPRINGS LOCK, TENNESSEE-TOMBIGBEE WATERWAY, MISSISSIPPI; HYDRAULIC MODEL INVESTIGATION,

MODEL INVESTIGATION, Army Engineer Waterways Experiment Station, Vicksburg, MS. J. H. Ables, Jr. Available from the National Technical Information Service, Springfield, VA 22161 as AD-A063 267, Price codes: A06 in paper copy, A01 in microfiche. Technical Report H-78-19, November 1978. 91 p, 28 Pl, 11 Tab, 4 Photos, 1 Append.

Descriptors: \*Locks, \*Hydraulic models, Navigation, \*Tennessee-Tombigbee Waterway, \*Bay Springs Lock and Dam.

This report concerns planning and design of a single lift, 110- by 600-ft lock (pintle to pintle), at the southern end of the Divide Section of the Tennessee-Tombigbee Waterway. Normally, an

84-ft lift condition will obtain, but a maximum of 92 ft or a minimum of 78 ft is possible at the site. A 1:25-scale model was built to study the filling and emptying system. The type system developed in the model test was a longitudinal floor culvert. Culverts in each lock wall are connected to a crossover culvert with a horizontal splitter wall dividing flow to upstream and downstream tuning forks where equal division leads into the two longitudinal floor culverts in each end of the chamber, near the chamber quarter point. The type 12 design tudinal floor culverts in each end of the chamber, near the chamber quarter point. The type 17 design model gave filling and emptying times of 10.5 min and 13.3 min. The prototype can be expected to fill and empty about 18 percent faster. Flow conditions in the lock chamber during filling were excellent with a very small degree of turbulence. The system developed is particularly desirable for high-lift locks in that it is insensitive to misoperation. (WES) W80-00916

INTERACTIVE COMPUTER-AIDED HYDRAU-LIC DESIGN: CULVERTS, California State Dept. of Water Resources, Sacra-

J. D. Spence, and B. E. Larock. Water Resources Bulletin, Vol 15, No 4, p 1153-1158, August 1979. 2 Tab, 7 Ref.

Descriptors: \*Hydraulic design, \*Culverts, \*Computer programs, Data processing, Hydraulic structures, Hydraulic engineering, Hydraulics, Mathematical models, Analytical techniques, Interactive computer program.

Regular use of interactive computer programs in hydraulic design can materially increase the productivity of designers without sacrificing accuracy. This paper considered the hydraulic design of culverts by interactive use of a computer program. An interactive computer program for the hydraulic design of culverts demonstrated the advantages lic design of culveris demonstrated the advantages of speed, convenience, and efficiency over batch programs for the same problem; any additional expenses over batch-mode computing are repaid by increased productivity and accuracy by the user. Primary practical impediment to use is the initial capital cost of terminals, which may be quite modest if they are used to operate a number of interactive programs. (Humphreys-ISWS) W80-00969

#### 8B. Hydraulics

SOLUTION OF LARGE SCALE PIPE NET-WORKS BY IMPROVED MATHEMATICAL APPROACHES, Southern Methodist Univ., Dallas, TX. School of Engineering and Applied Science. For primary bibliographic entry see Field 6A. W80-00869

TYPICAL TENNESSEE-TOMBIGBEE CANAL SECTION SPILLWAYS, SPILLWAYS A AND B: HYDRAULIC MODEL INVESTIGATION, Waterways Experiment Station,

Army Engineer Vicksburg, MS. B. P. Fletcher.

B. P. Pietcher.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A063 730, Price codes: A05 in paper copy, A01 in microfiche. Technical Report H-78-21, November 1978. 72 p, 5 Tab, 7 Photo, 21 Plate, 1 Append.

Descriptors: \*Spillways, \*Hydraulic models, Flow control, \*Tennessee-Tombigbee Waterway.

Model investigations were conducted to determine adequacy of the designs of two gravity spillways (Spillways A and B) to be located on the Tennessee-Tombigbee Waterway. Investigations were primarily concerned with evaluation of the tendency for surging of flow on the spillway tainter gates, defining the discharge characteristics of the structures, and ensuring adequate stilling basin performance. Models indicated basic features of the original design structures were unsatisfactory: however. and design structures were unsatisfactory; however, modifications that improved hydraulic performance were developed. There was no tendency for

surging on the tainter gates. Discharge characteristics of both spillways for controlled and uncontrolled flows were determined. Divider walls were located in the stilling basins downstream of the piers to eliminate unsatisfactory flow conditions that occurred during single gate operations. Additional features investigated in the model of Spillway B included measurement of crest pressures. No adverse pressures were observed. Addition of a 45-degree slope to the face of Spillway B did not affect hydraulic performance. The model also indicated stilling basin apron could be raised 9 ft without impairing performance of the structure. Size of riprap needed in the exit channel downstream was determined. Magnitudes of dynamic forces to be expected on the stilling basin divider walls were estimated. (WES)

INTERACTIVE COMPUTER-AIDED HYDRAU-LIC DESIGN: CULVERTS, California State Dept. of Water Resources, Sacra-

mento.

For primary bibliographic entry see Field 8A. W80-00969

UNSTEADY FEATURES OF FLOW PAST A

UNSTEADY FEATURES OF FLOW FAST A CAVITY,
Lehigh Univ., Bethlehem, PA. Dept. of Mechanical Engineering.
D. Rockwell, and C. Knisely.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY8, Proceedings Paper 14773, p 969-979, August 1979. 7
Fig. 22 Ref, 2 append.

Descriptors: \*Flow, \*Hydrodynamics, \*Turbu-lence, \*Model studies, Hydraulic models, Velocity, Shear, Vortices, Fluid mechanics, Flow character-istics, Unsteady flow, Hydraulics, Cavities, Im-

pingement.

Measurements of the distributions of total turbulence intensity across the shear layer and corresponding power spectra revealed that the presence of the impingement edge of the cavity decreases the total turbulence intensity by as much as 50% to 80% relative to the case of no edge; this decrease in total intensity is associated with the appearance of well-defined peaks in the power spectrum and a reduction in background turbulence level both at and upstream of impingement. Development of the flow down-stream of the impingement edge of the cavity is characterized by a decrease in the maximum value of total turbulence intensity and drastic variations in shapes of the mean velocity and turbulence intensity distributions of the boundary layer. Flow visualization at lower speeds suggests that these characteristics are associated with the distortion of large scale vortical structures convected along the wall downstream of impingment. (Sims-ISWS)

EXPERIMENTS IN LONGITUDINAL DISPER-SION WITH DEAD ZONES, Ministry of Works and Development, Wellington (New Zealand).

(New Zealand). E. M. Valentine, and I. R. Wood. Journal of the Hydraulics Division, American So-ciety of Civil Engineers, Vol 105, No HY8, Pro-ceedings Paper 14790, p999-1016, August 1979. 11 Fig, 1 Tab, 22 Ref, 2 Append.

Descriptors: \*Dispersion, \*Open channel flow, \*Turbulent flow, Laboratory tests, Hydraulic models, Numerical analysis, Mathematical models, Solutes, Flow, Rivers, Stream-flow, Turbulence, Hydraulics, Dead zone.

A series of laboratory experiments was reported which lent support for the need to consider the effects of dead zone trapping on the longitudinal dispersion process in natural streams. This may offer an explanation for the apparent non-applicability of Taylor's theory in some rivers. The results of an experiment devised to test the 'frozen cloud' of the process of the contraction of the con hypothesis with dead zones were presented. Ex-periments showed an increase in the dispersion coefficient and delay in arrival at the diffusive

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#### Field 8—ENGINEERING WORKS

## Group 8B-Hydraulics

person due to the presence of dead zones. These results were used to verify a two-dimensional computer solution which has been previously reported by the authors. (See also W78-00075) (Sims-ISWS) W80-00973

MEASUREMENTS IN INTERSECTING SUB-MERGED AND INDUCED JETS,

Illinois Univ. at Urbana-Champaign. Dept. of Civil

For primary bibliographic entry see Field 2H. W80-00977

HYDRAULICS OF CLOSED CONDUIT SPILLWAYS, PART XVII: THE TWO-WAY DROP INLET WITH A SEMICYLINDRICAL BOTTOM.

BOTTOM, Science and Education Administration, Minneapo-lis, MN. St. Anthony Falls Hydraulic Lab. K. Yalamanchili, and F. W. Blaisdell. Report AAT-NC-2, May 1979. 27 p, 10 Fig, 3 Tab.

Descriptors: \*Spillways, \*Laboratory tests, \*Model studies, \*Head loss, Flow, Flow characterrhodel studies, ried for from Flow characteristics, Hydraulic structures, Analysis, Hydraulic, Closed conduits, Hydraulic design, Energy loss, Pipe flow, Closed conduit spillways, Pressure coefients. Head loss coefficients.

This report presented the results of experiments on This report presented the results of experiments on two-way drop inlets with semicylindrical bottom for closed conduit spillways. The two-way drop inlet is a rectangular drop inlet having a width equal to the barrel diameter, a bottom semicircular in cross section, and a flat, horizontal antivortex plate supported above the drop inlet crest by extensions of the drop inlet endwalls. Two types of barrel entrances, referenced as A and B, were tested. In the type A entrance, the horizontal bottom of the drop inlet extended into the barrel beyond the downstream endwall where a vertical elbow changed the slope from horizontal to that of elyont the downstream enough where a vertical elbow changed the slope from horizontal to that of the barrel. In the type B entrance, the bottom of the drop inlet had the same slope as the barrel. Spillway performance of the type A entrance was described for several drop inlet heights, drop inlet lengths, and antivortex plate heights. For both lengths, and antivortex plate heights. For both types of entrances, effects of the midheight piezometer location, drop inlet length, antivortex plate height, and barrel slope on the crest loss, barrel entrance loss, and pressure coefficients for two-way drop inlets with semicylindrical bottoms were presented. Equations for computing the barrel entrance loss coefficients and the pressure coefficients on the barrel crown near the barrel entrance were developed, and their precision was discussed. were developed, and their precision was discussed. A method for computing the entrance loss coefficients was described. A summary of recommenda-tions presented criteria for determining the drop inlet dimensions for the type A entrance and listed the equations for computing the energy loss coefficients--crest loss, barrel entrance loss, and total entrance loss coefficients--and pressure coefficients. (Humphreys-ISWS) W80-01011

MODELING IN DESIGN OF PUMPING PITS, Utah Water Research Lab., Logan; and Colorado State Univ., Fort Collins. Engineering Research Center.

J. P. Tullis J. P. Tunis. Journal of the Hydraulics Division, American So-ciety of Civil Engineers, Vol 105, No HY9, Pro-ceedings Paper 14812, p 1053-1063, September 1979. 1 Fig, 28 Ref, 1 Append.

Descriptors: \*Pumping, \*Model studies, \*Hydraulic models, \*Mathematical models, Flow, Vortices, Pumps, Draft tubes, Hydraulic design, Hydraulic equipment, Hydraulics, Hydraulic engineering.

Hydraulic model studies of pumping pits will con-tinue to be an important part of the design process. Even though many studies have been completed, design criteria are not available that insure trouble-free operation of the pump. The paper discussed the role of modeling in the design of pumping pits and suggested methods for making them more effective. Included was a description of the various hydraulie problems uncovered by past studies and

successful solutions that have been developed. The article was not a technical state-of-the-art paper, but it did include several references to recent papers on the subject. (Sims-ISWS) W80-01019

RADIAL HYDRAULIC JUMP, Windsor Univ. (Ontario). Dept. of Civil Engineer-

ing.
A. M. Khalifa, and J. A. McCorquodale.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY9, Proceedings Paper 14825, p 1065-1078, September 1979. 12 Fig, 9 Ref, 2 Append.

Descriptors: \*Hydraulic jump, \*Energy dissipa-tion, \*Model studies, Mathematical models, Theo-retical analysis, Hydraulic models, Laboratory tests, Settling basins, Flow, Froude number, Energy, Radial gates, Air entrainment, Hydraulic structures, Hydraulic, \*Radial hydraulic jump.

Radial hydraulic jump occurs in a stilling basin with diverging side walls. Experimental data were used to obtain the free-surface profiles and the floor-pressure profiles within the diverging basin. floor-pressure profiles within the diverging basin. These profiles were used to develop generalized equations for the effective side wall forces for Froude numbers from 2 to 10. The momentum equation, which involves these forces, was then applied to develop an equation for the sequent depth ratio for the jump. For Froude numbers above 3, the sequent depth ratio was shown to be less than that for the rectangular jump. The length of the radial jump was about 70% of the length of a rectangular jump for the same initial Froude number. However, the volume of the jump was approximately the same as for the rectangular jump. The energy dissipation in the radial jump was approximately the same as for the rectangular jump. Sims-ISWS)

UNCONDITIONAL STABILITY IN CONVECTION COMPUTATIONS.

Colorado State Univ., Fort Collins. Dept. of Civil

Engineering. V. H. Chen, and D. B. Simons. Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY9, Proceedings Paper 14807, p 1079-1086, September 1979. 3 Fig, 2 Tab, 4 Ref, 2 Append.

Descriptors: \*Convection, \*Stability, \*Model studies, Mathematical models, Numerical analysis, Theoretical analysis, Diffusion, Dispersion, Linear programming, Equations, Circulation, Water circulation, Viscosity, Mathematics, Mathematical studies, Convergence ies, Convergence.

A theoretical treatment of the numerical properties A theoretical treatment of the numerical properties of a class of explicit schemes of the pure convection equation was presented. The von Ne umann and Hirt analyses were used to show that unconditional stability and second-order accuracy are both possible within the framework of an explicit formulation. Three unconditionally stable and second-order accurate explicit schemes were presented. In two of them, the weighing factors vary in time and space as a function of the local Courant number. (Sims-ISWS)

# 8C. Hydraulic Machinery

PROCESS FOR ACTUATING A HYDRAULIC PRIME MOVER THROUGH CONVERSION OF ENERGY IN WATER CURRENT,

U.S. Patent No 4,156,347, 11 p, 19 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 982, No 5, p 1590, May 29, 1979.

Descriptors: \*Patents, \*Energy conversion, \*Currents(Water), Ocean currents, Kinetics, Pistons, Hydraulic equipment.

The object is to provide a process for actuating a hydraulic engine in which the kinetic energy of

running water in an ocean, sea or river is absorbed through a working medium of an elastic substance. through a working medium of an elastic substance. The kinetic energy of the water is stored as potential energy by the elastic substance with the elastic substance then being positioned so that the absorbed energy can be released. The stored potential energy is converted back into kinetic energy for devisiting a hydraulic serging. The exceptions for driving a hydraulic engine. The arrangement for carrying out the process comprises at least one set of three coaxially disposed pipes. The central or main pipe serves as a cylinder to receive the im-pulses of the water current while the two sleeve pulses of the water current while the two sleeve pipes serve for bypassing the main pipe. A complex piston consisting of a chamber containing an elastic working substance and provided with a conventional piston is slidable in the cylinder and connected to an engine crankshaft. Valve and lock means are provided to regulate movement of the piston so that the kinetic energy can first be absorbed and stored as potential energy and later released to actuate the engine. (Sinha - OEIS) W80-00904

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# 8D. Soil Mechanics

DISPERSIVE SOIL PROBLEM AT LOS ES-TEROS DAM,

Army Engineer District, Albuquerque, NM T. N. McDaniel, and R. S. Decker. Journal of the Geotechnical Engineering Division, American Society of Civil Engineers, Vol 105, No G79, Proceedings Paper 14804, p 1017-1030, Sep-tember 1979. 5 Fig. 3 Tab. 6 Ref, 1 Append.

Descriptors: \*Soil tests, \*Earth dams, \*Clays, \*New Mexico, Laboratory tests, Dispersion, Soil stabilization, Dams, Filters, Sands, Test procedures, Analysis, Soil mechanics, Dam construction, Impervious soils, Erosion control, Soil amend-ments, Lime, Dam design, \*Los Esteros Dam(NM), Piping, Impervious cores, Dispersive soils, Sand filters.

Dispersive soil was discovered in the impervious borrow area at Los Esteros Dam, and through the use of sand filters and lime treatment of specific areas, the dispersive soil was used in the impervious core of the dam. Testing of the soil at the first laboratory was inconclusive, but testing at the second confirmed the soil to be dispersive. Tests were then conducted on the dispersive soil, sand filters, and lime-treated dispersive soil to determine whether sand filters and lime treatment could be used to control and alter the dispersive clay for use in the impervious core of the dam. Results of the program confirmed that a properly graded sand filter will control dispersive erosion through the impervious core, and that lime treatment alters the soil to a nondispersive material. A sand filter was soil to a nondispersive material. A sand infer was constructed downstream of the impervious core, and, where based of the impervious core is founded on a fractured sandstone, a 5-ft thick layer of the core was treated with lime. (Humphreys-ISWS) W80-00974

## 9. MANPOWER, GRANTS AND FACILITIES

# 9B. Education (In-House)

UPTAKE OF METHOXYCHLOR FROM FOOD AND WATER BY THE AMERICAN TOAD (BUFO AMERICANUS),

Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center. For primary bibliographic entry see Field 5A.

# 10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication
And Distribution

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specific impervithe first g at the ve. Tests ooil, sand etermine could be y for use ts of the ded sand bugh the alters the filter was bus core, is found-layer of mphreys-

ECONOMICS OF WEATHER MODIFICATION: A REVIEW, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 6B. W80-01008

HYDROMETEOROLOGICAL CHARACTERISTICS OF SEVERE RAINSTORMS IN ILLINOIS, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 2B. W80-01009

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